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AN ANNIVERSARY NUMBER.

Last week we reached our highest water mark, up to that time, in an issue of 72 pages, the size and contents being such as to bring in upon us overwhelming congratulations from friends and readers all over the country. Marking as it did the close of our fifteenth year, the issue was naturally taken as a good exemplification of the great growth of electrical science and industry in the period since the first number was published in 1874; and we felt that at so memorable a milestone on the road of progress we might fairly take the advice once given by a famous statesman after a noteworthy achievement, and "rest and be thankful." But we are called upon this week once more to meet larger demands, and rising to the occasion we now put forth a number containing no fewer than 96 pages, or a gain of 24 pages over the previous record of a single week before. We cannot but call attention to a stride so tremendous. There is no need for us to enlarge upon it, or to emphasize its importance as evidence of the enterprise of electrical journalism in America, and the vast extent attained by the department represented in the arts and sciences. The number speaks for itself, from the first line to the last, and, big as it is, we know that every page will be turned and read with interest.

THE NATIONAL ELECTRIC LIGHT CONVENTION AT CHICAGO.

Our pages this week will be found to contain a full report of the convention held last week at Chicago, by the National Electric Light Association. What was done there our readers have already been advised of by our "Bulletin," of which no fewer than six editions of several thousand copies were printed and distributed while the convention was being held. The "Bulletin," which has now been issued at six successive conventions, embraced not only the history of the body and its revised constitution, but gave the list of officers, the programme of business, a report of the proceedings twice a day, and a full list of electrical people in attendance. This, done by the staff of THE ELECTRICAL WORLD a thousand miles from home, was in itself no mean achievement, but we now follow up that performance by the present issue, three days later in New York, of a paper containing 96 pages, compared with which all our own prior issues, themselves without precedent, sink into insignificance.

Turning to the extended report now appearing in our columns, the first matter that will attract notice is the animated discussion which took place on the subject of underground wires. It was hardly expected that the question would be taken up so spiritedly, but no sooner was the drift and meaning of the report and resolutions seen than the advocates and opponents of underground wires rallied to their respective banners. For a time the feeling was very warm and even embittered, but the good sense and sound judgment of the more conservative elements in the body prevailed, and the convention closed as it began, in peace and harmony. We are glad that the convention did not declare the undergrounding of high tension wires to be entirely feasible. Searching and long as the discussion was, on the report presented by Mr. E. T. Lynch, Jr., it failed to bring out many facts that could encourage electric light men, on whom, after all, the burden and expense rests, and it must be clear to all of impartial mind that much yet remains to be done before arc light wires can be put under ground with the same confidence and success as those for low potential incandescent service. On the whole, we think it an excellent thing that so keen a discussion on fundamentals arose. Mr. Morrison, with his usual insight, was correct in saying that the subject ought to be well ventilated at that time; and the manner in which theory and practice were then dealt with must convince everybody, both of the good faith of the electric light men in asking for more time and of the equal sincerity on the part of the underground men, in believing that they can remove the difficulties. The matter will be "settled as we go," and the final solution is neither of to-day nor of to-morrow.

Another very vital topic brought before the convention, but not receiving the attention it should, owing to lack of time, was the ownership by municipalities of electric light plants. The papers of Messrs. Foote and Whipple deserve very careful perusal. It is true that they dealt specifically with electric lighting, but the principle involved is one of the most pressing of modern times. The idea was forcibly combatted that municipalities should engage in commercial undertakings, and Mr. Foote's able paper makes us wonder once again how the proposition could ever have found many supporters. That a man should operate an electric light plant any better because he is a municipal officer, bears a title and draws a salary from the public chest, is as incomprehensible as that the efficiency of dynamos can be increased by painting them red. The fallacy that governments or municipalities can do work cheaply was long ago exploded, and we trust that the advance of electric light, hampered as it already is by numerous drawbacks, will not be checked by the growth of new superstitions in that respect.

The papers on the use of oil as fuel, by Messrs. Leonard, Francisco, and Ransom, were among the most useful and practical before the convention. We must confess to a special relish for this class of papers at such meetings, and would like to see more of them, on such themes, for example, as methods of station book-keeping, the best division of labor in a station, the advantages of various groupings and classifying of apparatus, the desirability of conforming to certain rules in station construction. These are live topics, and the members can pour out a wealth of experience in regard to them and others of the same kind. The subject of insurance was also well treated by Mr. Barton assisted by Mr. Alexander, Mr. Ridlon, Mr. Killecutt and Captain Brophy, and though there were dark shadows in the picture drawn by some, the outlook was after all shown to be bright. The day of bad work and cheap stations is rapidly passing away, and while there is still abundant room for improvement, we see on every hand commendable solidity and stability in construction and equipment.

In its choice of officers the association has done admirably. Although the remarks of Mr. Morrison and Mr. Duncan, declining to stand again for the presidency were, in a sense, private, we have printed them to show how ready leading members of the body are to let personal honors pass in order to promote its welfare and to allow of that rotation in office which is not only an excellent theory carried out in our political and social life generally, but tends in its operation to strengthen and build up an organization. In selecting Mr. Weeks, the association acted wisely and with justice, for though that gentleman has ever been most reluctant to accept office, he has always been foremost in devoting his time and thought to the affairs of the Association. He is a man of weight, of education, and of ability. He represents at least two of the great systems of electric lighting not before recognized in the presidency, and he is an honored citizen of one of the most progressive sections of the country. Under his administration, the body will assuredly gain in numbers and influence, and come still nearer the point of public usefulness that its founders and members have ever had in view.

The exhibition of apparatus far exceeded anything that had been anticipated, and reflected the greatest credit on Mr. Sunny, Mr. Barton and Mr. Kreidler, the local members of the Executive Committee, and the other Chicago members associated with them. The big City of the Lakes had a splendid object lesson in electrical development that it will not soon forget, and the stimulus to electric lighting and power cannot be over-estimated. It stands to reason that such a display could not possibly be given at each convention, but the determination to signalize the visit to Chicago in this way was eminently shrewd and sensible. The result must undoubtedly have gratified all who took part, and justified them in the heavy expenditure, even if they do look forward with feelings of relief to the comparative ease and pleasure that the trip to Niagara promises next August.

IRON OR HEMP COVERED CABLES.

The question of the relative merits of iron or hemp sheathed ocean cables in regard to their life and the speed of working attainable has recently occupied some space in our columns. It will be remembered that Judge Weatherbe, of Halifax, drew attention to the fact that an iron sheathed cable contained within itself the elements of its own destruction, and subsequently Captain Trott pointed out that, in addition, the electro-magnetic effect of the current on the iron sheathing, as noted by Prof. George Forbes, acted to retard the signals. Leaving out of consideration the rapid decay of the iron sheathing which, unquestionably, experience has fully demonstrated, we find the other, viz., the retarding effect of electro-magnetic induction, taken up and discussed by Sir William Thomson in his address before the English Institution of Electrical Engineers. While recognizing that such an effect does take place, Sir William points out that while it might come into consideration in a cable not exceeding 100 miles in length, theory shows that its effects in long cables are completely masked and overbalanced by the electro-static action which limits the speed of working. He goes on further to state that as proved mathematically by Heaviside, the electro-magnetic induction is an actual aid to speed in transmission on long cables, helping to carry the current by an action analogous to inertia. With the opinion of so high an authority before us, it would seem bold to suggest that a crucial test of this question by the laying of a cable without iron armor would nevertheless bring out some points which may not have been considered in this problem. As stated above iron employed as a mere protection can be replaced by hemp with success, as has, we believe, already been practically proved. With this question decided, that of the possible speed of working alone remains, and while theory may guide us largely in this matter, the problem seems to us of sufficient importance to adhere to the belief that cable telegraphy is still open to improvement in more than one direction, and that the matter of the best type of cable to be used for that purpose is not yet among the *res adjudicata*, so far as evidence from the working of iron-clad cables can settle it.

Edison Patent Sustained in England.

Special Cable Dispatch to The Electrical World.

LONDON, Feb. 17, 1889.—A decision has just been rendered here in the higher appeal court by the Lord High Justices, reversing the decision of Mr. Justice Kaye in the lower court, and sustaining the lamp patent of Edison, as owned by the Edison-Swan Company, against Holland, whose cause has been maintained by the Anglo-Brush Corporation. The decision is given without damages or injunction against the Anglo-Brush Corporation. In this suit, Mr. Justice Kaye decided that the Edison carbon "filament" patent was invalid on the ground that the specification was defective in its description of the invention and process of manufacture, not being such, in fact, as would enable a workman to comprehend the method and make the filament.

Ninth Meeting of the National Electric Light Association.

The ninth convention of the National Electric Light Association was held at Chicago, in the Exposition Building, beginning Feb. 19, and was called to order about 12:30 P.M. by President S. A. Duncan. The following gentlemen were in attendance during the sessions:

AKRON, O.—C. Pellinger.
ALBANY, N. Y.—Mayor E. A. Maher, A. B. Uline.
BALTIMORE, Md.—W. T. Biedler, J. F. Morrison, C. Selden, A. Steuart.
BOSTON, Mass.—G. W. Adams, H. G. Ashton, G. L. Austen, M. J. Baird, S. E. Barton, L. C. Bass, Capt. W. Brophy, L. W. Burnham, D. Clapp, C. A. Coffin, H. B. Cram, W. R. Davis, L. M. Dillon, H. E. Duncan, H. H. Eustis, F. Gilbert, Alfred Jansen, D. Killecutt, A. F. Mason, J. H. Mason, James F. Meech, F. E. Pettingell, C. M. Ransom, Frank Ridlon, R. F. Ross, H. C. Spaulding, T. W. Sprague.
BRADFORD, Pa.—J. C. McDowell.
BRIDGEPORT, Conn.—C. P. Bullard, H. D. Stanley.
BROOKINGS, Dak.—C. E. Gaylord.
BROOKLYN, N. Y.—Chas. Cooper, J. L. Jensen, E. F. Peck, S. J. Simmons.
BUFFALO, N. Y.—C. R. Huntley.
CHAMPAIGN, Ill.—H. E. Woods.
CHICAGO, Ill.—F. N. Armour, C. B. Askew, F. B. Badt, E. Bagot, Force Bain, Theo. P. Bailey, E. J. Ballou, C. M. Barclay, J. L. Barclay, G. M. Barker, J. P. Barrett, E. M. Barton, S. A. Barton, G. L. Beetle, W. S. Belding, J. C. Bennett, P. A. Bennett, F. Bennett, Robert Bines, G. H. Blaxter, G. H. Bliss, S. E. Bliss, F. N. Bosson, William Boylston, C. A. Branch, J. Brison, C. A. Brown, H. G. Brownell, H. D. Brukins, J. R. Burdick, C. A. Burns, F. Butterworth, W. A. Carroll, M. C. Chase, S. S. Chisholm, C. S. Colton, T. P. Conant, G. L. Corson, A. Crossman, C. B. Curtis, Geo. Cutter, J. Davidson, F. E. Degenhardt, C. Desmond, F. De Land, C. H. Dexter, J. W. Dickerson, D. H. Dorsett, A. C. Durborow, Jr., L. A. Ferguson, A. Fiske, E. Gabel, R. D. Garden, C. K. Giles, H. A. Glasier, J. H. Goehst, W. Goodhue, C. E. Gregory, C. J. Hamlin, W. A. Hammett, F. W. Harrington, G. A. Harter, C. C. Haskins, A. J. Hewlings, E. S. Hewson, L. S. Hill, N. F. Hodson, W. Hood, F. W. Horne, H. H. Hotchkiss,—Houston, E. M. Izard, W. J. Johnson, G. J. Johnson, A. Kempt, A. C. Knapp, M. A. Knapp, W. A. Kreidler, H. W. Leonard, A. D. Lundy, W. C. Lyman, Geo. W. Marble, C. D. Matterson, G. A. Mayo, W. H. McKinlock, Geo. A. McKinlock, L. Mendelsohn, F. H. Miller, W. W. Munroe, C. H. Munson, J. J. Nate, J. B. O'Hara, F. W. Parker, W. B. Pearson, D. P. Perry, F. L. Perry, W. H. Pierce, E. L. Powers, W. H. Preble, E. B. Preston, J. K. Pumpelly, Dr. E. Pynchon, H. A. Reeves, C. H. Rudd, F. A. Sargent, L. A. Scovil, C. D. Shain, J. H. Shay, J. H. Shields, E. C. Sims, H. G. Smiley, G. M. Smith, Elmer A. Sperry, D. B. Steadman, C. H. Stephens, A. K. Stiles, W. A. Stiles, B. E. Sunny, W. M. Talcott, S. W. Tanner, Wm. Taylor, A. K. Tenny, F. S. Terry, J. M. Thomas, A. Thompson, —— Thompson, G. H. Wadsworth, C. C. Warren, W. G. Whitmore, C. H. Wilmerding, E. F. Williams, C. Wilson, E. E. Wood.
CINCINNATI, O.—E. V. Cherry, H. E. Cooke, L. W. Davis, A. R. Foote, J. F. McClure, L. Poland, E. B. Richart, T. J. Ryan, T. G. Smith, Jr., L. H. Weissleder.
CLEVELAND, O.—K. D. Bishop, W. H. Boulton, C. S. Britton, W. B. Cleveland, S. D. Cox, J. B. Crouse, C. C. Curtiss, H. E. Hayes, W. S. Hill, W. H. Lawrence, E. S. Sanderson, J. S. Scoville, A. J. Wright.
COUNCIL BLUFFS, Ia.—T. Officer.
CUYAHOGA FALLS, O.—S. L. Babcock, E. L. Babcok.
DAVENPORT, Ia.—Wm. Bowen.
DAYTON, O.—G. N. Bierce, J. R. Fletcher.
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ELGIN, Ill.—W. Hubbard.
ELMIRA, N. Y.—F. A. Cheney.
ENGLEWOOD, Ill.—C. T. Page.
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GARRETT, Ind.—F. W. Brandt.
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MALDEN, Mass.—A. E. Bliss.
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WILMINGTON, Del.—H. B. Cobb.
WINDSOR, Conn.—M. E. Baird, A. D. Newton.
WORCESTER, Mass.—T. C. Bates, H. H. Fairbanks.

President Duncan introduced Prof. J. P. Barrett, the city electrician, who, in behalf of Mayor Roche, welcomed the association to Chicago, and promised the mayor's attendance next day.

President Duncan then read the following address:

PRESIDENT'S ADDRESS.

But few of the gentlemen of this country, who are commercially connected with the manufacture and distribution of electric light and power and the apparatus used therefor, are aware that five years ago this month, a handful of men met in this city and organized a movement which has grown into the large and powerful organization of which we are members and which is in session at the present time.

The industry of electric lighting at that time was carried on with all the enthusiasm which comes with a new undertaking and with the mistakes which are sure to arise in the commercial introduction of any great industrial agency. The gentlemen engaged therein, strangers to one another, working independently with no attempt at harmony, with but little knowledge of one another's methods of business, with no established custom or precedent to guide them, came together for the purpose of deriving those benefits which invariably result from the deliberate discussion of those mooted questions which are common to the experience of all electric light men.

To even enumerate the topics which have been discussed at the various conventions of this association, the reports which have been rendered by special committees, the papers which have been presented by recognized experts in the various departments of electrical engineering, and the discussions which have taken place between those well qualified to speak, would consume more time than your president feels at liberty to take for such a purpose from this association. Fortunately, the association is in possession of a complete set of published proceedings from the first convention down to the present time, and of these volumes many hundreds now reposing in the electrical libraries of this country and abroad, testify to the steady and yet rapid growth of the industry and the increased information on the part of the whole electrical fraternity on the general subject of electric light and power. It may be remembered that in the early days of this association, the chief question before the electrical fraternity was the then all-important question of arc lighting. The incandescent light had scarcely come into commercial use. No sooner had the questions involved in arc lighting been solved by the natural pressure of public demand than the complicated questions involved in the distribution of incandescent lighting absorbed the attention of the fraternity and occupied the meetings of this association. Following closely upon the problem involved in incandescent lighting came the question of electrical distribution of power: first for stationary motor purposes, and afterward for the purpose of electrical locomotion. This question is to-day perhaps the most important one before the electrical fraternity. To say that electrical power is not to-day a success, would be to reflect upon the scores of electrical railways now in successful operation in this country, and upon the thousands of electric motors that are every day commercially serving the wants of man.

	February, 1888.	August, 1888.	February, 1889.	February, 1888, to February, 1889.
Central station and isolated plants	4,000	5,351	5,747	.....
New central stations and isolated plants	.....	1,351	716	2,067
Per cent. increase of central stations and isolated plants.	.....	32.3	13.5	50.1
Arc lamps	175,000	192,500	219,924	.....
Increase of arc lamps	.....	35,201	27,424	62,625
Per cent. increase of arc lamps	.....	20.1	14.2	34.3
Incandescence lamps	1,750,000	2,142,440	2,504,490	.....
Increase of incandescence lamps	.....	392,944	361,546	754,490
Per cent. increase of incandescence lamps	.....	32.3	16.7	49.0
Increase in capitalization of electric light companies	.....	$42,210,100 Total.	$27,187,634	$69,397,744 Total.
Electric street railways in operation	.....	34	Inc. 19	53
Electric street railways being built	.....	83	Dec. 39	44
Electric street railways incorporated but not yet contrated for	.....	39	Inc. 3	42
Electric cars in operation	.....	2.3	" 155	378
Electric cars under contract; roads not yet finished	.....	244	" 185	329
Miles of single track in operation	.....	138	" 157.5	294.5
Miles of single track under contract, not yet in operation	.....	189.5	" 84.25	273.75

We may here profitably consider some figures indicating the growth of the electric lighting and power industry, the increase in the number of central stations, arc and incandescent lamps, electric motors and electric railways now in operation. At the meeting of this association one year ago it was estimated that there were not less than four thousand central stations and isolated plants in operation in the United States. From the accompanying statistical table, it may be seen that the number of central station and isolated plants at the August meeting of 1888, was 5,351, and at the present time is 5,747. This shows an increase during the first six months of the year of 1,351 central station and isolated plants and an increase during the latter half of the year of 716, making a total increase during the year of 2,067 plants. Figuring in percentages, the increase during the first half of the year was 32.3 per cent. in the total number of central station and isolated plants, and during the latter half of the year it was 13.5 per cent., making a total increase for the year of 45.8 per cent. It was estimated a year ago that there were 175,000 arc lamps in daily use in the United States. Six months ago I found upon investigation that there were 192,500. At the present time I find that there are 219,924, making an increase during the first half of the year of 62,625 arc lamps, and during the latter half of the year an increase of 27,424, making a total increase of arc lamps in use during the whole of the year 32,525. Figured in percentages the increase the first half of the year shows 20.1 per cent., the second half 14 2 per cent., making a total gain of arc lamps for the year of 34 3 per cent. A year ago it was estimated that there were 1,760,000 incandescent lamps in daily use in the United States. Six months ago I found that there were 2,142,440. At the present time there are no less than 2,504,490, making a gain during the first half of the year of 392,924, and during the latter half of the year of 361,596, or a total gain for the year of 754,990 incandescent lamps. Figured in per cent, it shows a gain during the first half of the present year of 32.3 per cent., during the latter half 16.7, a gain during the whole year of 49 per cent.

It is also interesting to notice what the increase in capitalization has been in the electric light companies of the United States during the year. During the first half of the year the increase was $42,210,100; during the latter half it was $27,187,634, making a total gain during the year of $69,397,734.

It is also interesting to note some comparative figures upon the electric railway industry. Six months ago there were 34 electric railroads in operation in the United States. During the last six months there has been an increase of 19, making at the present time a total of 53. Six months ago there were 83 roads in process of construction. There are 39 less at the present time, making the number of roads now under construction, not finished 44. Six months ago there were 39 electric roads incorporated in the United States upon which construction had not yet begun; at the present time there are 42. Six months ago there were 223 electric cars in operation. Since that time 155 have been put into commission, making at the present time 379 cars in operation. Six months ago there were 144 cars under contract but not in operation. This number has increased by 185 during the last six months, making a total of 329 electric cars at present under contract, but not running. Six months ago there were 138 miles of single track in operation; during the past six months there has been an increase of 157½ miles, making a total at the present time of 294½ miles of single track in operation. Six months ago there were 189¾ miles of single track under contract but not in operation. At the present time there are 273¾ miles of single track under contract but not in operation. It would be profitless for me to draw elaborate deductions from these figures; they tell for themselves the story of prosperity and rapid growth throughout every department of the electric light and power industry.

Acting under resolutions passed at the last convention, the president of this association established a headquarters in the city of New York in charge of the secretary and treasurer on the 1st day of October, 1888, which action was confirmed by the executive committee on November 19. From this office has been carried on a voluminous and elaborate correspondence with the whole lighting and power fraternity of this country not only upon the subject of the work of the various committees of the association, but also in regard to this most important feature—the exhibition of electric light and power apparatus. For the first time in the history of the National Electric Light Association, this has received the prominence which it merits. The exhibit which appears in the other rooms of this building testifies not only to the interest which is shown by the electric lighting and power men of this country in the apparatus which is now before the market but it also shows the fact that the manufacturers and dealers in apparatus and supplies are willing to put themselves to expense and trouble to bring their wares to our notice in a suitable and proper way, when we are gathered at our meetings. Although this movement originated prior to the last convention and the correspondence pertaining thereto has been carried on by the New York office, I wish to say that much of its success is due to the admirable and methodical management of the chairman of the executive committee, Mr. B. E. Sunny, of Chicago.

We are gathered at the present time, gentlemen, not only for the purpose of seeing an exhibit of the latest forms of electrical apparatus and supplies, but primarily for the purpose of listening to papers and discussions upon all important electrical questions. I will not burden you with a detailed account of these reports and papers and discussions which will come before this body. Some of the subjects deserve special mention. Petroleum for fuel first received attention from this body at its last meeting. At this present meeting several papers will be presented upon this all-important subject. The question of the materials of underground conduits in relation to the insulating materials of cables will also be treated. The mooted question of static charge on underground cables, and the attendant puncturing thereof, will also be the theme of an elaborate paper. Electric light stations as fire risks will be comprehensively treated by a recognized expert in fire underwriting who has given special time and attention to this particular branch of the subject. The question of municipal lighting which is pressing upon the electrical fraternity to-day, will be the subject of one or two papers and no doubt of a profitable discussion. The numerous committees of this association have reports to make upon subjects which will be of much interest to all. The committee on underground conduits and conductors has carried on an enormous correspondence with the entire electric lighting fraternity of this country and it seems eminently proper that the information they have gathered should be presented in this city of Chicago where the subject of the undergrounding of electric lighting wires has been more practically carried out than perhaps in any other city in the world. This question which is at present one in which diverse opinions are held by men of equal professional standing is one which this association cannot afford at the present time to ignore or overlook.

This association is at the present time in a flourishing financial condition. By this we do not mean that we are rolling in wealth, but that we are comfortably able to pay our bills. Since our last meeting the entire membership roll has gone through a revision, the membership at the present time being vested in individual names instead of corporations. This has, of course, involved an enormous amount of correspondence and a vast outlay of time and trouble. It has, however, been successfully accomplished, and at the present time the roll of live, new members testifies to the wisdom of this action. Although the association numbers among its members every gentleman actively interested in the electrical distribution of light and power, it is an undisputed fact that it should contain not less than three times that number. It is believed that the association is now on that "tide in the affairs of men which leads on to fortune." With the proper exercise of care in the management of the association, it is felt that the enormous growth of the industry and the consequent influx of hundreds of men into its ranks will lead to a much greater increase in the roll than there has ever been before. The gain of new members since Jan. 3 evinces the fact that an interest is being taken in the association by the community at large.

The next business was the calling of the roll. A few members not present were represented by proxy.

On motion of Mr. J. F. Morrison, twenty-five members hereafter constitute a quorum for the transaction of business.

On motion of Dr. Moses, the chair appointed on the Committee on Constitution and By-Laws Messrs. Moses, DeCamp, Perry, H. D. Stanley and Candee.

A motion of Mr. Geo. M. Phelps, to appoint a committee for nomination of officers of the Association for the ensuing year was, on motion of Mr. Jensen, of Brooklyn, laid over until next day.

The secretary's report was then read. Referred to the executive committee. This report showed a total membership of 175 in good standing.

The treasurer's report showed a balance on hand of over $2,500, including donation of $212 from Prest. Duncan.

The report of the Committee on Patent Legislation was read by Mr. Arthur Steuart, Chairman.

MR. ARTHUR STEUART: I have only to make a report to you of what has been done during the past six months, and to state that we have accomplished something in the direction in which we have been striving, but we have not done all that we hoped to do, but we feel that we are in a position to carry on this work with success in the near future. At the last meeting of this association held in New York, I had the honor to report to you that the bill which we had introduced in Congress was pending before the Judiciary Committee, and that I had reason to expect that the committee would make a favorable report on our bill, and recommend its passage by Congress. Since that time they have made a report and I will read the report which they have made.

REPORT OF COMMITTEE ON PATENT LEGISLATION.

The committee on the judiciary, to whom was referred the bill (H. R. 9084) to establish a court of patent appeals, have considered the same, and report it to the House and recommend its passage, with amendments herewith submitted.

The court of patent appeals as provided for by the bill and amendments reported by the committee, consists of one chief justice and two associate justices, who shall be appointed by the president, by and with the advice and consent of the Senate, and who shall hold office during good behavior, and receive a salary each of $6,000 per annum.

The associate justices shall take precedence according to the dates of their commission, or when the date of the commissions may be the same according to age.

The bill provides for the appointment of a clerk, deputy clerks, marshal and reporter by the court. The fees of the clerk shall be the same as now allowed by law to the clerk of the Supreme Court, but shall not exceed $6,000 a year. The salary of the marshal is fixed at $2,000 per annum.

The pay of the reporter is not to exceed $2,500 annually, unless the number of reports required to be printed shall be increased by order of the court, in which case the salary or pay may be increased, not exceeding $1,500 a year.

The court is required to hold one term annually at the seat of government, commencing on the second Monday in October, and may hold special or adjourned terms as the court may deem proper for the dispatch of business.

The jurisdiction of the court as prescribed as defined in the bill is as follows:

SEC. 14. The Court of Patent Appeals of the United States shall have appellate jurisdiction in the cases hereafter specially provided for without regard to the sum in controversy:

1. From the courts of the United States having original jurisdiction of cases touching patents, copyrights, trade-marks and labels, in all cases involving these subjects.

2. From the commissioner of patents in all cases touching the patentability of inventions, priority of invention among several claimants for patents upon the same invention, and in all cases of re-issue and the judicial practice of the patent office; also all cases touching the registration of trademarks and labels and the rights of conflicting claimants therefore.

SEC. 15. From and after the passage of this act there shall be no appeal from the Circuit Courts of the United States or any territorial or district court or courts of the District of Columbia, in cases touching patents, trade-marks, copyrights or labels to the Supreme Court of the United States directly, but all such cases formerly appealable to the Supreme Court shall be heard on appeal by the Court of Patent Appeals.

SEC. 16. There shall be a right of appeal from the Court of Patent Appeals to the Supreme Court of the United States in all cases, regardless of the amount in controversy, subject to the same regulations, however, as now exist with regard to appeals to the Supreme Court in causes of admiralty and maritime jurisdiction, and to such further regulations as the Supreme Court of the United States may make.

SEC. 17. All cases touching patents, trade-marks, copyrights, or labels now pending before the Supreme Court of the United States awaiting trial shall be transferred to and heard by the Court of Patent Appeals.

The expediency and propriety of, if not necessity for, the establishment of such a court as contemplated by this measure will not be questioned if proper consideration be given to the objects that will be attained by the passage of this bill.

Among the results reasonably expected to flow from the organization of the court of patent appeals, attention may be called to the following:

(1) It would enable the public and patentees to determine the value and validity of patents without serious and vexatious delays, and thus promote the interests of all concerned.

(2) It will relieve the Supreme Court of much of the burden imposed upon it by this class of litigation.

(3) The practice in the patent office would become thoroughly fixed and understood, and, as a consequence, the issue of worthless patents, in which unscrupulous persons deal to the injury of the public, would be greatly diminished, if not entirely suppressed.

(4) It would tend to simplifying the patent laws by construction and settle questions of doubt which are often used by litigants for the purpose of injustice and oppression.

Without intending to present the reasons at length which induce your committee to arrive at the foregoing conclusions, the following observations are submitted:

The life of a patent at most is seventeen years, and if it is a valuable one, or intricate and radical, it usually requires one-fourth of that period to introduce it and secure its use by the public.

This, in part, results from the fact that manufacturers who must be relied upon to make and introduce new inventions are slow and reluctant to place in general use invent ons which displace or render valueless articles in the production of which they are already engaged.

This is illustrated by experts, who say that to change from one style of gun to another requires from $1,000 to $2,000, and from six months' to a year's time to make the model gun from which to make the dies, gauges, special tools, etc., and that to make these latter, much time and money are required.

When ordinarily the financial life of a patent is abridged by the difficulties of placing the invention into general use, we can appreciate the importance of speedy decisions when it is infringed or when its validity is questioned.

Under the present condition of the business of the courts it requires, ordinarily, from two to three years to obtain a decision in the circuit courts of the United States, and if appealed to the Supreme Court, from three to four years are required to obtain a decision then. It may be said that the same difficulty and delay attend the determination of all other questions involving the determination of property rights. While this is true, it should be borne in mind that this species or character of property differs from all other kinds of property. The duration of the owner's title is arbitrarily fixed by law. The period is short, for the most part seventeen years.

The constitution imposes upon Congress the duty of securing to authors and inventors, for a limited time, the exclusive right to their respective writings and inventions. It is submitted, respectfully, that this duty is very imperfectly discharged when, by the omission of Congress to provide proper means to determine questions arising out of patents, the life of a patent may be frittered away by the delays of the law.

As has been said, it requires from three to four years after a cause has been filed in the Supreme Court to obtain a decision. This does not result from any fault of the judges. It is due solely to the fact that Congress has so broadened the appellate jurisdiction of the court as to overburden the physical capacity of the tribunal.

The original jurisdiction of the court, fortunately, is fixed by the constitution, and Congress cannot add to it or subtract from it; but the appellete jurisdiction of the court is subject to the power of Congress, and that authority has been exercised without proper regard to the physical capacity of the judges or the interests of litigants.

This condition ought not to be continued. It operates in a great many cases as a denial of justice, and every citizen of the United States is interested in bringing about a change.

It may be asked how this measure will contribute to the result. To that inquiry it may be answered that, by the sixteenth section of the bill, as quoted herein, it is provided that appeals from the court proposed to be established to the Supreme court shall be subject to the same regulations as now exist with regard to appeals to the Supreme Court in cases of admiralty and maritime jurisdiction, and to such further regulations as the Supreme court may make.

By reference to the act of 1875, relating to the practice in the courts of the United States in cases of admiralty upon appeals to the Supreme Court, and the rule of the Supreme Court upon that subject, it will be observed that the Circuit court is required to make a finding of facts and law, and the review of the judgments of the circuit courts by the Supreme Court in these cases is confined to questions of law only.

It follows that if a similar rule shall be applied to patent cases as the sixteenth section of the act provides, the Supreme Court in reviewing the judgments of the court proposed to be established will pass upon questions of law only, and thus from fifteen to twenty per cent. of the time now consumed by the court in these cases in wading through voluminous records, endeavoring to find the facts, will be saved and profitably applied to the disposition of other business in the court.

It is difficult to perceive any good reason for requiring the Supreme Court to find the facts in patent cases and not in admiralty.

Upon the score of economy, it is respectfully submitted that the expenses of this court will not exceed $30,000 per annum.

Such a sum of money bears no comparison to the amount that will be saved to the people of the United States by the speedy adjudication of questions arising out of patents. To this should be added, also, the incalculable advantage that will result to litigants in the Supreme Court of the United States from the saving of time.

The income of the Patent Office for the fiscal year ending June 30, 1888, was $1,122,994.88; expenses, $953,730.14; leaving a surplus turned into the treasury of the United States of $169,264.49, which, added to the previously credited surplus, makes a balance in the treasury to the credit of the patent fund of $3,337,666.65.

Mr. Steuart added:

At the last meeting of the association, I read in your hearing letters of recommendation which I had received from the members of the Supreme Court of the United States, recommending the passage of this bill and the establishment of this court. I have in my hand a letter from the Secretary of the President of the United States, in which he says that he has given the matter very careful consideration and is deeply interested in the establishment of a Court of Patent Appeals. I also have here a quotation from the President's message of December 3, 1888, in which he says:

"The crowded condition of the calendar of the Supreme Court of the United States, and the delay to suitors and denial of justice resulting therefrom, has been strongly urged upon the attention of the Congress, with a plan for the relief of the situation, approved by those well able to judge of its merits."

I have, finally, a letter in my hand from the chairman of the Judiciary Committee who made this report, and who has our bill in charge, and who is doing everything possible to have it pass. Together with the chairman, I have moved all the powers that were at my command during the past six months to secure a time for the consideration of our bill. There is no opposition to it whatever. It is very favorably considered by everybody. It is indorsed by all the highest authorities. There is no reason why it should not be passed, except that the calendar of the house is so overcrowded with other bills, and the time of the house is so occupied with political matters that nothing of a private nature can be expected to be acted upon. I have here a letter from Judge Culbertson, in which he says: "The committee on rules did not consider favorably the proposition to give the committee on the judiciary time for the consideration of our bill for a court of patent appeals. That being the case, the committee on rules has entire control of what bills shall be considered, and unless they give the time for the consideration no bill can get place before the house." Judge Culbertson continues: "The understanding is that no further reports will be made from the committee on rules, and unanimous consent to fix time for the committee on the judiciary having being denied me, I suppose it will be impossible to do anything with the bill during this session."

It is simply buried under an enormous mass of other matter. But the bill is in shape for introduction into the next Congress, and everything is ready for us to begin work again in November, with every reason to expect that we will succeed. We began to consider this matter at the early part of the present Fiftieth Congress. It took six months to get the bill into such form as we could all agree upon. It was filed in April. It took me until the first of September or latter part of August to get this report from the judicary committee favoring the bill and recommending its passage. Since then you have heard its fate; it has lain with thousands of other bills. As I said, it is in condition to be taken up as soon as Congress meets. Several members of the Judiciary Committee will be the same in the next Congress as they were in the past. The present chairman will be in that committee, and out of courtesy to him this bill, I understand, will be given some precedence and this report recommended again, and we may expect to get it on the calendar among the very first bills of the coming session.

I have to make a report of expenses and disbursements. I stated at the last meeting that some money would be necessary to carry on this work. I sent out a circular asking the members to send me a little money for the purpose, and I received $190. Of that $110 has been expended. I have $80 left. That $110 has been spent for printing, postage and the employment of a clerk during such time as it was necessary to have one. There is one other matter that I want to mention. In the early part of last year it became necessary for me to have the indorsement of the Supreme Court of the United States to this bill in order that it might have the favorable consideration of the committee. In order to do that it became necessary that I should secure the services of some member of the bar of the Supreme court of the United States who was intimately acquainted with the members. I had an interview with George Ticknor Curtis on the subject. He told me that he would undertake to procure the consent of the Supreme court for a fee of $250. I said to him, I cannot undertake to say that I will pay you $250, for I must get that money from the voluntary contributions of the members of the association. I wrote them for the purpose, asking them to supply it. I said to Mr. Curtis. "If you choose to do what is necessary to be done now, I will do all in my power to secure that fee for you from the members of the association." He agreed. I sent out my letters and got $50 only. I paid him that. I have $80 in my hand. I believe the former treasurer has a balance of some $15 in his hands, and that will make $95 available for this purpose. That leaves a balance of $105, which I think we are in duty bound to pay. This gentleman served us very faithfully. He secured for us that which will enable us to pass this bill; he secured the unqualified indorsement of the Supreme Court of the United States; he secured letters from Justice Miller, and from the late Chief Justice Waite, and from others, and we are now in a position with that indorsement to go forward and pass that bill and carry out the reforms in this direction which we have in view; and I would be indebted to the members of the association if they would enable me to meet this obligation. It was not an obligation of the association; it was clearly understood that it should not be so.

On motion of Mr. De Camp the report was received and filed.

The Secretary, in the absence of Mr. G. F. Porter, read the report of the Committee on Transportation, which was received and filed.

The Committee on Insulation of Wires and Installation of Plants, not having any report to offer, was, on motion of Mr. Morrison, discharged.

Dr. O. A. Moses reported in behalf of the Committee on Electrical Education, that Columbia College of New York, in founding a course in electrical engineering, had so effectively taken up the work of that Committee as to render its further services unnecessary. On motion of Dr. Moses, seconded by Dr. Morrison, the committee was discharged.

The reports of the other committees were laid over until Wednesday.

MR. MORRISON: Before the adjournment, and in view of the fact of the proposition having been made to appoint a committee to nominate to this convention officers for the ensuing year, it becomes my duty, although a somewhat delicate one, to make a statement here which savors somewhat of personality. I am glad there are so few people present, and would ask that this be not made a part of the official record of the Association. It looks too much like talking of one's self.

THE PRESIDENT: The chair will state that if it is of such a nature as that, if you do not want it printed, we had better go into committee of the whole.

MR. MORRISON: I take it for granted the press will extend that courtesy when the request is made. It is only a few words. I think the time has arrived when the officers of this association should be nominated in open meeting and voted for by ballot, and every other safeguard thrown about the paying members of this association to enable them to give a free and untrammeled expression of their choice. Therefore when the question comes up I should oppose the appointment of a committee to nominate for the convention that which I believe should be done by themselves in open meeting. Now I rise to say that since my arrival in Chicago Sunday night, I have been waited upon by a committee composed of 40 odd members of the association, who asked to be allowed to use my name as a candidate for President of the National Electric Light Association. I want to say to this association, at least to the old members of it, that they know the trouble I had in getting rid of that office. It was too much of a labor to ever permit any one knowing the circumstances of the case to have any idea that I would voluntarily seek the office again. I want to go still further and say that there is no inducement that I know of that could be offered—there are no combinations of circumstances which could prevail—that would induce me under any circumstances to allow the use of my name as a candidate for this office. I have served you; my time has passed away; the Association is growing and every year new men are coming into it; instead of looking backward and reaching over your shoulders for old men who have served their time and passed out, reach forward and pick up the new men and young men, the men who have kept up with the progress of the age, and from that class of men select officers from time to time to govern the convention. These are my sentiments. The one particular point I want to make I again reiterate—that under no circumstances is any one authorized to use my name, and under no circumstances could I be induced to accept the office of president if it was unanimously offered me by this convention. I say this with a full feeling of gratitude to all the members for the courtesy and kind treatment which was extended to me during several years when I presided over their deliberations. (Applause.)

THE PRESIDENT: While the statement of the gentlemen from Baltimore was entirely privileged, the chair extended to him the full courtesies of the house to make the statements which he has. In regard to the question which came up this morning upon the motion of Mr. Phelps, of New York, the chair declined at once to appoint any such committee, and placed it in the hands of this association, so that the gentleman from Baltimore and the chair accord perfectly in regard to the principle. If there is any other gentleman who has a personal statement to make, now is the time, before we adjourn.

The convention then adjourned until 10.30 A. M. on Wednesday.

WEDNESDAY'S SESSION, FEB. 20, 1889.

The Convention was called to order by President Duncan at 11:15, after which Dr. Otto A. Moses presented a gavel to the President, on behalf of the Central Electric Company, of Chicago. The head of the gavel represented a section of Okonite cable.

The secretary then read invitations from the Chicago Edison Company to visit their station, and from Mr. Potter Palmer to visit the new storage battery plant placed in his house by Messrs. Conant & Hood, of the Electrical Accumulator Company.

Mr. E. T. Lynch, Jr., then read the

REPORT OF THE COMMITTEE ON UNDERGROUND CONDUITS AND CONDUCTORS.

At the eighth meeting of the National Electric Light Association, held in New York, on August 29, 30 and 31, 1888, the following resolution was offered and adopted:

Resolved: That a committee of five be appointed by the Chair, to examine into and report upon the systems of underground conduits, with underground conductors and conduits now in operation, and the number of wires actually in use in these conduits, and to report at the next meeting of this Association.

The president appointed Messrs. Lynch, Barney, Kerr, Davis and Crocker, as members of that committee. And as chairman of that committee, I beg leave to submit to the association the following report:

As the resolution called for a compilation of all data connected with the actual placing of electrical wires underground, your committee deemed it advisable to send out a circular, calling upon and asking all the the local electric light companies for the results of any practical tests that they had made.

To carry out this idea, they caused to be printed the following circular:

GENTLEMEN: A committee was appointed at the semi-annual convention of the National Electric Light Association, held in New York, Aug. 29, 30 and 31, to investigate and collect all data relating to underground wires and conductors, both in this country and Europe. It is the intention of this committee to present this report at the Chicago Convention of this association, which will be held on Feb. 19, 20 and 21, 1889.

So many erroneous statements have been made from time to time regarding experiments or tests with underground wiring that the committee, (in order that it may hear both sides of the question,) feels that it is necessary to obtain all of the most important details and facts regarding this subject.

Will you therefore kindly answer, as far as may be in your power, the following questions and return the same to the headquarters of the Association as soon as possible. Your answers to

these questions will be looked upon as confidential, and will not be referred to by name or locality in the report of the Committee. It is desirable that you send in your answers at once, as the compilation of statistics takes time.

ALLAN V. GARRATT, Secretary. EUGENE T. LYNCH, Chairman.

1. Have you ever placed underground any electric light conductors carrying currents at a potential of 1,000 volts or over?
2. If so, state the number of experiments, giving the date of each?
3. What was the length of each individual conductor laid underground?
4. What was the voltage on each conductor?
5. What was the current, in ampères, carried by each conductor?
6. What make and style of dynamo supplied the current on each of these conductors?
7. Were these conductors single or grouped in cables?
8. How many conductors to the cable?
9. What was the size of the conductors used (in answering this question give the number and gauge)?
10. What was the thickness of the insulation?
11. Who was the maker of the cable.
12. Were the cables laid in any form of conduit?
13. If so, what kind of conduit was used?
14. Describe the manner in which the cables were laid in the conduit; whether drawn in, built in, or otherwise?
15. If the cables were laid directly in the ground, describe the method of laying them?
16. Was there more than one duct in the conduit?
17. If there were other ducts what was in them?
18. Did you have exclusive control of the conduit?
19. What was the total duration of your experiments?
20. Did the cables work satisfactorily during the entire time of your experiments?
21. If not, how long did they work satisfactorily?
22. If the cables failed to work satisfactorily, to which of the following causes do you attribute the difficulty? Please answer as fully as possible:
   a. Defective insulation?
   b. Defects in joints?
   c. Defects in making connections from cables to lamps?

Those were sent to all of the local electric light companies, and in response to them we have received 120 answers.

In presenting and compiling the answers to the various questions that were sent out, we have deemed it advisable to divide them into two classes as follows: Those who have had actual experience in placing and running underground electric wires, and, those who have not had actual experience, but whose opinions we have asked. Of the former class there are but seven. We will here give the details of the placing of the wires underground, the duration of tests, style of conduit used and the general results that were received in each of these seven answers. As it was stated in the circular sent out that all the communications would be regarded as strictly confidential we have deemed it advisable that the names of the companies or individuals should not be mentioned in this report; consequently we will not refer to them by name.

FIRST: The writer has used the underground conductors for three years. Has used wire of three of the most prominent manufacturers. Has discarded two, and is now using the third.

The cables were carried in a cement pipe, and manholes were placed at every 250 feet. Cables had been drawn into the conduits, and as a method of facilitating their drawing in, pulverized soapstone had been used for the purpose of avoiding abrasion.

Only one wire placed in each pipe.

He states that the wires have not worked satisfactorily, and that he has been compelled to shut down many times, that they are now running fairly well, but he is obliged to keep them under constant supervision and repair.

He accounts for most of the trouble that he has experienced, by defective insulation, defective mechanical construction, and by deterioration in the insulation in the wires, having had no serious trouble with the style of conduits that he has used.

In answer to the question, regarding the practicability of placing his conductors underground, he states: "We are operating some eight miles of underground wire; we wish there were less, and certainly are not anxious for more."

In answer to the question, regarding the difficulties and objections to underground wiring, and whether he considers them commercial, electrical or mechanical, he states:

Electrical.—There is no cable that will last with a current from a 50-light dynamo. Commercial.—Owing to the large cost of construction and expense of maintenance, and great possibility of breaks. There is consequently poor service and dissatisfaction. He has exclusive control of his conduit.

SECOND: The writer has made many experiments, in which he has used lengths of cable varying from 200 feet to two miles in length, manufactured by most of the prominent wiring companies. Cables have been laid in, and drawn in, his own conduits, conduits constructed both of wood and iron. The tests have usually been of short duration, and have been suspended in each case after a failure of the cable to work satisfactorily. The cause of the failure has been mainly defective insulation. Defective mechanical construction, defects in laying, defective conduits, injury to cables in laying or defective joints, have caused very little trouble, the main cause of trouble being in defective insulation and deterioration owing to the presence of gas, water and steam.

His opinion based upon the results brought out by the many tests that he has made is that he does not consider it practical at the present time to place conductors underground, the absence of insulation that would stand being the principal reason. If ever that question is settled the cost would, in his estimation, make it commercially impracticable. In only one instance he had the exclusive control of the conduit.

THIRD. The company represented by the writer had four circuits underground for about one year. One style of cable only, manufactured by a prominent manufacturer, was alone used. The wire was drawn into a composition conduit, which had manholes at the corners.

Quite an amount of trouble was caused in the start-off by difficulty caused by abrasion to cable in drawing the wire into the conduit. The experiments were continued for one year. They caused a great deal of trouble with the lighting contracts, and at the end of that time were abandoned. He considers his chief troubles to be defective conduits, water in the conduits and deterioration of the cables, also, trouble in defective insulation, defects in the joints and trouble in making connections through iron pipes from the conduit to the surface.

His opinion, based upon the results of the tests that he has made, is: "that he does not consider it practicable to place his wires underground," and he states, "I do not know of any system that has yet proved satisfactory." And further states: "I know of no system to-day which, even at any expense, has proved satisfactory, except a system of subways built large enough for men to walk through their entire length."

In answer to the difficulties of placing wires underground, he states that he considers the difficulties to be commercial, electrical and mechanical in perfection, and still not be so expensive (in the end) as to make the commercial objection insurmountable. "We are all in the business simply to make money, and the commercial objection must be met just as much as any other." He did not have exclusive control of the conduit. The ordinance passed by the Common Council in his city in 1886, stated "that their committee had examined the subject and found the putting of all electrical wires underground feasible, and ordered all wires within a few months, and those outside of this district, underground within one year." He has been brought before the court a number of times on complaint of the City Attorney, but nothing yet has been done in the matter.

FOURTH: The writer has made two experiments during the last summer, one of which was a failure, and the other a partial success, though the duration of the second test and the position it occupied in the circuit was such as to give little importance to the result. The wires were pulled into a wooden conduit, there being two ducts in each conduit. Cables did not work satisfactorily. He states that the failure is due entirely to defective insulation.

In answer to the question if he considers it practicable to place his conductors underground, he replies, "We do not, with any system known at present."

In answer to the last question, concerning the difficulties and objections to placing wires underground, he states: "The difficulty is particularly commercial, though I have seen no system which I think will properly insulate the conductors."

FIFTH: The writer has placed two circuits underground, about the first of the present year. The cables used are those manufactured by six of the most prominent companies. They have been drawn into an asphalt conduit, twelve ducts in each conduit. The duration of his experiment has only been about a month and a half, and he states that it is too early to tell what will be considered the result of the experiment.

In answer to the question if it would be considered practicable to place the wires underground, he states: "Have seen nothing yet that will answer."

In answer to the question regarding his opinion concerning difficulties and objections to going underground, he replies: "Chiefly commercial, partly electrical and partly mechanical." He has exclusive control over his own style of conduit.

SIXTH: The writer has had wires in the conduits for about five years. The mains were carried through the streets in a composite system of conduits. The connections are made from the system to the cellars through iron pipes, and the wires are conveyed then through cellars, connection being made from the cellars to the houses. These cellars run completely around the block and permit of access to them for the purpose of repairing or making connections to wires.

He has used three different kinds of wires in the conduits, the cables now in use having been in position for about thirteen months; although he has had trouble with them, he claims that satisfactory service can be maintained in his particular locality, and he considers the question of the distribution of power and light an exceedingly simple one in his city, which is probably the only city that is so fortunately situated.

He has in all about 32 circuits. He states that he is on the right track regarding the placing of wires underground, and that the system such as he operates will run satisfactorily. The cables that he is using are guaranteed for three years. The trouble that he had with his first wires, was mainly due, as far as he can ascertain, to the fact that the insulation surrounding the wires was not of sufficient thickness, and the main conduits themselves were not dry. He controls his own conduits exclusively.

SEVENTH: The writer has made some practical experiments and tests with cables under water; these were manufactured by two of the most prominent companies. The cables did not, however, work satisfactorily, lasting, as they did, from three months to one and a half years. He lays the cause of failure to the effect of water upon the cable, and the deterioration in the insulation of the wire. His opinion, based upon the tests he has made, is that he does not consider it practicable to place his conductors underground. Considers that the difficulties are both electrical, mechanical and commercial. Had exclusive control over such conduits as he used.

In summarizing the results of the experiments in these cities, in one case only did the electric light company place its wires underground willingly. In all others they were forced to do so by the local authorities.

In only one instance have the experiments or practical workings proved satisfactory. The only other case that they did not report adversely, being where the wires had only been in operation about 40 days. The average voltage that they have used on all the circuits tested was 1,893 volts; the current was 10 ampères. The average thickness of insulation over wires was $\frac{3}{32}$ of an inch; and the average length of cables tested in each case, was about 4,600 feet.

In considering the second class of answers, namely, those who have not yet made any extended practical test, their answers have been directed mainly to the last four questions, the first two of which, relate to action by the municipal authorities, and the last two, consider the practicability and the difficulties of placing wires underground. In very few of these cities have the municipal authorities yet taken any steps towards action upon the matter, having been delayed in awaiting the solution of the underground question in other cities.

In answer to the question, asking them if they considered it practical to place their conductors underground, 104 have replied that their opinions based upon tests that they have seen and such information as they have been able to obtain, both in this country and abroad, is "that it has not been practical to place the wires conveying high tension electric arc light currents underground."

Two have answered that they considered it practical to do so, but state that at the present time they have no wires underground.

In answer to the question which asks their opinion regarding the greatest difficulties to be met with in considering the placing and operating of underground wires, they all unite in the opinion that "the difficulties are both mechanical, electrical and commercial." They consider that the question of obtaining a satisfactory conduit has not been properly solved; and that even if that should be solved in the future, that we cannot even at this time obtain a satisfactory insulation for the wires that will not deteriorate within a few years, and become perfectly useless as an insulator when subjected to the action of steam, water and gas. The great difficulty of making connections for buildings and lamps, and the absence of any satisfactory system of subsidiary conduits, is considered by all as a bar to successful operation, as the difficulty of drawing in cables without abrasion to the insulating covering, even with the most careful handling, is very great.

The commercial objection is considered a very great one, as not only is the first cost about eight times heavier than that of an overhead system, but the repairs to the cables due to the deterioration of the insulation, and other defects caused by mechanical or electrical deficiencies, would be very much heavier than the expense of operating and maintaining overhead systems, and that the prices at which they are now furnishing the electric light would have to be very materially increased to meet these extra and very heavy expenses. A system of tunnels through all the principal streets is considered to afford the only means for the solution of this problem.

There are many other responses to the circulars, in which the writers state that they have had no experience with underground lines, and have not yet considered the question in the light that we have placed it before them.

The committee also sent a letter asking many of the questions that were sent in the circular, to all of the electric underground wire companies, and in response received quite a number of communications from the cable companies. Most of them said that at the present time they were unable to give any information in regard to underground wiring, as they have had very little experience with wires for that purpose, but that they do not doubt that in the future the state of the art will permit of the wires being placed underground, and that their particular company will be well equipped for doing so.

Other companies reply that the wiring of their system that has been used for underground purposes has been for potentials under 1,000 volts, and that they have met with entire success with potentials of a system with 1,000 volts. And they do not anticipate in the future that they will have any trouble in furnishing wire to meet the requirements of the electric lighting companies, but at the present time they have not yet done so. They unite in stating that they think that the question of the insulation of high voltage of currents should be solved by the using of good durable thick insulation. Their experience in conduits has been, that they do not want creosoted wood, but would prefer to have their wires buried in the ground or under water, and would recommend at the present time that single conductors should be used. They seem to be about evenly divided on the question as to whether lead-covered cables should be used for underground purposes.

On motion of Mr. Charles Cooper the report was accepted and placed on file.

Mr. A. STEUART: I would like to ask a question of Mr. Lynch. He quoted the figures of 104 persons from whom he had communications on the subject. Did I understand him to say that all those 104 had used an underground conductor for this purpose.

Mr. LYNCH: No; those were simply opinions of those people.

Mr. STEUART: How many of them have used underground conductors?

Mr. LYNCH: There were only seven who had made practical tests, but the opinions I read of the one hundred and four were based upon information that they had obtained and tests that they had seen, and their opinion was that they did not consider it practical at the present time. They also summarized their objections to it, which were commercial, electrical and mechanical, all three combined.

Mr. M. J. PERRY: To how many local companies did you address yourself?

Secretary GARRATT: I can answer that, sir, 1,066.

Mr. PERRY: Of whom 104 made a response and of that number only seven were actual users.

Mr. LYNCH: Yes sir. The 1,066 to whom circulars were sent included isolated companies a great many of whom simply light buildings and have no wires underground at all.

Mr. PERRY: How many central stations?

Mr. LYNCH: 130 central stations. We had a report from Chicago which referred us to some former communications that had been made on the subject.

Prof. J. P. BARRETT: Is there any objection to reading the communication?

The PRESIDENT: None at all, sir.

Mr. LYNCH: A communication was received from Chicago in answer to the circular which referred us to the remarks made in New York as being their opinion on the subject and as having all the data.

Prof. BARRETT: You have no communications as to Chicago at present?

Mr. LYNCH: Not since last August. Our remarks were based on remarks that were given to us in August last.

Prof. BARRETT: If this convention is in condition to receive information in regard to underground conduits. I will be glad to offer it. (Applause.) I want to say, Mr. Chairman, for the benefit of this Convention that we are using underground service here for the last thirteen years.

Mr. LYNCH: For electric light?

Prof. BARRETT: We are using electric light for the last six years. The municipality of Chicago purposes to extend it indefinitely so far as the limits of Chicago are concerned. I was in hopes when I came here that I should receive some information from other communities. Now it is a singular thing to me, I am not entirely posted as to the variety of questions being asked here, but when I see in this convention gentlemen who are prepared to present conduits, prepared to guarantee to construct them and maintain them in any form that you require, and right along side of them, gentlemen prepared to furnish you conductors that will carry anything you want—in face of that fact, I find it stated by this report that it is an impracticability. We think pretty well of it here, and we have got plenty of it in service. I would be glad to offer any assistance I can to demonstrate that fact.

Mr. W. H. JOHNSTONE: I am another aggrieved party. I did not receive a circular. I have been in the electric light business, underground, for five or six years. I have been operating a plant in Philadelphia during that entire time with perfect and uniform success. We have constructed a plant in New York for the same purpose at a very great expense. The reason why gentlemen say the conduits are not practicable is that they have not seen them. They would not look at them. They have been invited time and again to come and see the practical operation of these conduits, the conductors carrying a voltage which they say is impracticable.

In 1883 we laid two miles of conduits in Chestnut street, Philadelphia. At the time the state of the manufacture of the insulation was in a somewhat primitive condition. To-day they have advanced so far that they are willing to offer us wires with a guarantee of three or five years duration of any insulation that we require. Even with that very weak insulation which we had in 1883, which was made of pure rubber—and they did not understand that a heavy conductor lying in that soft rubber would naturally thin the lower portion out and crowd it up on the top—even with that, some of those conductors in a year or eighteen months, were working straight along with a Hochhausen Excelsior machine, and you all know what that machine is. Mr. De Camp has had an opportunity of seeing all that. They finally, in order to get rid of this obnoxious competition, bought us out. We crowded them so closely and took so much of their trade that they said: "We had better get rid of Johnstone," and they did by paying for it, immediately after that having a majority of the stock.

The PRESIDENT: The chair would remind the gentleman that we are not on this stock question. Confine yourself to the underground matter. The stock matter is a sort of personal question.

Mr. J. F. MORRISON: I think that a discussion of this kind ought to be allowed to have the broadest possible range. I think the little spur which Mr. Johnstone is applying will go a long way toward eliciting information in return that will be of the greatest value to this association. One of those things which might be considered an evil perhaps, is that we sit with open doors and we are glad to have all those who desire to visit us, here. Now we are sitting with open doors. The speech of the gentleman is very interesting. I have no doubt that he is applying the lash where it will be promptly responded to, and I think it will be not only a pleasant thing for the Association, but it will greatly advance their interest and enlarge their sources of information to permit Mr. Johnstone to go on in his own way. (Applause.)

Mr. JOHNSTONE: Thank you. I was saying that they did not want this thing to succeed, and therefore they took advantage of the opportunity I spoke of and got possession of it. They ran it to suit themselves, and in a very short time it was announced that arc electric lighting was not practical and that they would have to utilize these conduits for an incandescent circuit. They were then making a a very handsome income per week, which was paying the institution nicely. They transferred it into an alternating system, and took as few customers as they possibly could, and, consequently, the thing was reported to be bankrupt.

It is not bankrupt, but the conduits are there and are

being used to-day. Mr. De Camp has charge of the entire thing, and the conduits are, nevertheless, going right through underground. Now, when it comes to conduits, I have spent eight years in nothing else hardly, and in eight years the most ignorant man in the world will learn something. We started out with the idea of grasping the entire subject. The difficulties were electrical and mechanical. The electrical difficulty we knew we could deal with; the mechanical difficulty was the serious one. The first difficulty was expense. It is more expensive than creosoted wood, or asphalt, or something of that kind, but when you put it down you have a comprehensive thing that fulfills every possible idea you may suggest, and I now challenge any gentleman in this convention to ask me a question as to the distribution or handling of an electric light current for its commercial uses that I cannot take him right out in this hall and show him how it is done, and that he will not say to me, "That is right; I see how it is done." Now, that iron is the best material electrically, I think we will all admit. That it is the material for economy, we have absolutely got to admit, and, consequently, I do not see what this report is constructed upon. Mr. Lynch and I have had a very pleasant experience in New York with law suits and all that sort of thing, but we have got the legislature and the people of this country on our side, and we will put your wires underground whether you want them or not.

If you do not want to put them underground at your own risk, here stands an individual who is prepared to give bonds to put them in in any town or city in the country and make more money out of them than you are now making, if you will simply enter into an agreement that if we do that we shall have so much money for the trouble we are put to, because we are working for money, and we do not want to take any risk unless you are brave enough and broad enough to assume the responsibility and put the wires where they belong. You talk about abrading the conductor, drawing it in and out. You cannot abrade a lead cable. Lead does not cut. I will undertake to draw your cable, I do not care whose it is, without doing it any damage. Now, let us proceed to business. To put a cable overhead is a menace to life and property, and it is a very great economy to put them below. Now, if you are afraid to do it yourself, I know half a dozen gentleman in this room who are willing to do their share of it. Now, let us meet this thing fairly. I am going to make a proposition, and I hope to have a unanimous vote on it in my favor. This resolution was passed a year ago by this intelligent body of gentlemen, and I must say that I never saw gathered together such an intelligent body of scientific men who knew what they were talking about, or believed they did, that would stand up in New York one year ago and pass a resolution, stating that there was no scheme presented that was commercially practical for putting electric light wires underground. Now, I move that we rescind that—

Mr. MORRISON: I rise to a point of order. My point is that a motion being before this convention, it is not proper to make a new motion.

The PRESIDENT: The operation of your motion would be the same as the previous question, which we do not have in this body. Proceed.

Mr. JOHNSTONE: We are laying in New York City conduits that have cost now quite a million of dollars. After a very long fight the New York Subway Commission was organized to do a very great work. Whether it was organized for the purpose expressed on its face, we will not discuss, but they commenced at the tail end of the thing and backed up and finally got to it. Finally, after they spent this million dollars, companies like friend Lynch's company said to them a year ago, "Show us how you are going to lay your wire." That was all right, but we were dealing with people, and our orders came from those people. So they commenced to construct a system that went by the proud name of the "Johnstone System." They said, "I guess we will have to have it." They have laid about four miles up to the present time, and it has proven satisfactory to the minds of those people who were so bitterly opposed to this system. Now we have laid that conduit in Broadway and we are going to have it on 125th street, and I promise you that this coming summer the electric conductors in New York will all go under ground, and our good friend, Mr. Lynch, will have to reverse that report in a very short time.

J. B. ECCLESINE, JR.: Do I understand that the report of the committee has been adopted?

The PRESIDENT: It has been received.

Mr. ECCLESINE: Has there been any motion to adopt it?

The PRESIDENT: No, it is before you for discussion.

Mr. MORRISON: If the chair is wrong I hope the convention will right it. The papers are presented here for the purpose of eliciting discussion. It is only through that channel that you can receive proper information on this line. I may have my opinion and a number of other gentlemen theirs, and in the present condition of the underground business, so far as the electric lighting companies are concerned, that is most plainly illustrated by the report just read, which has been the result of a great deal of patient labor, and shows that we are certainly fit subjects for the schoolmaster in that line.

Mr. ECCLESINE: If the report has not been adopted, let me make, then, a maiden effort on my part in the electrical world. I will here confess that I may be somewhat prejudiced, as I am a cable man. While the report was being read I received a communication from one of the members saying that he was glad that he was not a cable man, and I agree with him; we were glad he was not, too. Therefore I may have some prejudice; but listening to the report attentively, as the labor expended on it deserved, and as carefully as I could, the first thing that struck me was the lack, the absolute dearth, of any prejudice against recommending underground wire. The report was strained in its effort not to recommend the adoption of underground; I noticed that the number of communications that the gentleman had solicited from the electric light companies and given consideration to were where underground was a failure; any success seemed to be overlooked or was not reached by the committee. It struck me also that the report of the committee was made up of these objections, and that therefore it was made up to hold good the resolution that had declared in New York that underground was not a success, but a failure, and in order to support that, this report was somewhat strained in its effort to sustain the belief that it is impracticable at present to go underground. There have been, I believe, for some time past, underground stations worked successfully, not one of which the report happens to name. I take Professor Barrett's word for it that he has worked underground successfully, and yet Professor Barrett is thoroughly known in this country, and the report fails to say anything about Professor Barrett's experience, though I have no doubt if they had applied to him for his experience, he would have sent willingly what information he had. In fact, all the information the report brings is damaging to underground; not one single feature in favor of it. The resolution that is to be supported by this report, which was passed last August, I think was one of a very sweeping nature. It was the effort of people to say, "We don't want to go underground, and therefore we will say boldly we cannot go underground." The electric light companies that have answered the gentlemen of the committee are evidently not desirous of going underground; but I think the people of the country are desirous to have them go underground; the people in the great cities are desirous to have them go underground, and they will finally, if they keep up this blind opposition, find themselves very much in the position of the Scotch cow on the railroad track—it will be "mighty bad for the cow." They will be compelled to go underground by public opinion. Now nothing can be done without an earnest effort, and I do not think there is any earnest effort on the part of the committee to find how to go underground, but a very strong and earnest effort to find how not to go underground. When the report of the committee comes up for adoption I propose then to move a resolution rescinding the resolution passed last August. I propose to do that not because of the opinions of the people, but because of the facts that exist. These facts there are gentlemen here who can testify to; there are gentlemen here who can testify to the fact that underground lighting has been successfully performed where the men wanted to do it.

Mr. T. CARPENTER SMITH, of Philadelphia: I have spoken now at two or three conventions on the subject of underground wires—spoken of them to such an extent that I find it necessary to set myself straight with a good many gentlemen here present. I do not stand here to declare that overhead wires are dangerous, or that the wires have to go underground. I believe to-day, after our experience of nearly three years with underground circuits and an experience of six years with overhead circuits, that overhead work, if it is properly done, with good material, good workmanship and careful watching, is the safest method of distributing power known to us; that when you take into consideration the amount of power there is being distributed through electric light wires on overhead circuits, taking the one city of New York, or the one city of Philadelphia, and comparing it with the accidents that occur every day or every hour with any other form of transmitting power, that you find that it is incomparably safer. The case that I know of best perhaps is in our own town of Philadelphia. I do not quite know of how many miles of overhead conductor there are in that city, but I judge I am rather within the mark when I say 100 miles.

Mr. DE CAMP: Two hundred.

Mr. SMITH: We have in Philadelphia, I believe, in the neighborhood of 100 miles of street car track, something in that neighborhood. Now in these two hundred miles, which Mr. De Camp tells me is the mileage of Philadelphia, we are distributing in the neighborhood of three or four thousand horse power, and we are doing that on an average of sixteen hours a day. When you consider that on any one of these overhead wires the whole current of the dynamo, representing from fifty to sixty-five horse power, can be realized not at every mile of that wire or on every foot of that wire, but at every one-thousandth of an inch at any moment you see the potentiality of that distribution is enormously greater than anything else that can be calculated. Yet what do we find the actual results in practice? In Philadelphia last year there has been one death from an arc light current, caused at a fire by a fireman cutting a telephone wire which dropped across an old underwriters' wire circuit and coiled itself up in two or three rings where it struck the ground. A little boy running across the street ran across this wire, and in his endeavor to get away from the shock twisted the wire around himself and fell in the gutter and was picked up dead. What do we find in the miles of our car tracks operated by cable companies? Twelve deaths caused where people were going home and fell off the cars or were knocked down by the cars and were run over. Now I think the reason of the public opposition to overhead wires on account of their danger and their permitting these cable cars to run, there never being any great complaint about the danger of them, can be arrived at in this way: Everybody uses the cable cars more or less; they are a great public convenience; so are the electric lights. Why is it that people think the cable cars more of a convenience than the electric lights? Simply because the cable cars have broken down a dozen times and driven it home to the mind of every man in that city that the cable cars must not be interfered with on any account because they interrupt public business; while the electric lights have not broken down and on account of the good service they have done they do not get proper recognition from the public. I want to put myself on record as a strong and earnest advocate of overhead circuits where it is possible. They are easy to repair, they are easily kept in order; if there is anything wrong with them it is quickly seen. But on the other hand I must say I do not consider that this report is at all a fair one to the underground wires. (Applause). When any company wishes to adopt a new system using perhaps some particular form of electric apparatus, and somebody goes to them and says: "Now look here; we want you to consider our new system; we can lick that new thing you have bought all to pieces." What do they do? Do they go around and ask those companies who are not using that system what their opinion of it is? Not much; they pick out men who are using that system and go to them to see what has been their success with it. Any man who can only say, "I think this," or, "I hear this," they throw aside. His opinion carries no weight whatever. They go to men who have had that in actual use and ask them what their experience has been. They are not content with taking the say-so of people; they try to find out the reasons for its failure. Now I am not aware that I have ever seen that circular sent out by Mr. Lynch's committee. I represent the Keystone Construction Company, Philadelphia, and we are operating an underground station. We are doing so because we could not help it. If we could have gone overhead we would have gone.

Mr. LYNCH: May I interrupt the gentleman one moment to say we sent out a circular to every member of the Association.

The SECRETARY: The Secretary will say that there is no appropriation for the work of this committee. It was carried on very economically, and I regret that we had to send them out under a one-cent postage—second-class postage—and I imagine many of these circulars never reached their destination. I think they ought to have gone out with a two cent stamp and sealed. That probably accounts for many of these things. Prof. Barrett received one, but there are other gentlemen who say they have not received it by mail.

Mr. SMITH: I do not wish to be understood that the committee did not intend it. I merely wish to inquire whether the report had been received in my absence. I speak from my own knowledge of our station. We have had a great deal of trouble with underground wires, but somehow have managed to keep our lights going straight along. It has cost us less to do that than any similar amount of overhead wire that I know of. When we went into this thing we went into it experimenting. There was nobody in this country could tell us anything about it. Fortunately for myself when I first went into the electric business, some seventeen years ago I served my time in a factory where we made submarine cable. I do not know but what some gentlemen here may know it, the factory in North Woolwich. While working in that factory I had an opportunity of seeing a great many accidents that happened to ocean cables; we went out in boats and hauled up the cables and found that the accidents were more mechanical than electrical; trawlers had broken the lead covering of the cable off, and so on. When we went into this alternate current business, after running for awhile, I was met with a regular storm of assertion that we never could run alternate currents, as the induction would be too great. I made up my mind that if I simply soldered my lead coverings together and connected them to the ground wherever possible, I would have the equivalent of a copper conductor covered with insulating material and buried in the ground. We did so and have not had one particle of trouble from induction or anything but mechanical defects or defective insulation. We have found that almost any form of cable that you can use in the form of lead-covered cable does not get proper handling when it is put in. We instruct our men as well as we know how; we threaten them with discharge if they do not do exactly as we tell them; and then they will go to dinner on a damp, muggy day and leave the ends of the cable sticking out to absorb moisture. When the cable was watched carefully and the ends of the cable sealed when they were not in actual work, we have had no trouble. With cables we do not watch personally, in every case they have broken down and in nearly every case it is because it has taken some damage and the moisture worked back into the cable and found the weak spot in the insulation. Now I think in making up the report or making inquiry as to electric light service underground, that the money which was spent in sending out a thousand circulars to companies who were not using underground wire would have been much better applied in making a careful examination into the companies who were. The old story of the man who stole the cow, and who brought twenty men who did not see him do it to oppose one man who did see him do it, will apply in this case first rate. The men who have done the work, the men who are using the work, are the men whose opinions are to be taken. I do not consider that experiments made with a quarter-mile, or a half-mile or ten miles of cable six years ago have very much bearing on this question; for it is only within the last two or three years that a really intelligent attempt has been made to put in underground service. I do not want to say anything about conduits. I am interested in conduits, and therefore keep away from them and do not want to say anything about them. The great trouble we have to face is the question of distribution. Now I want to be as fair as I possibly can be on this subject and I am free to say I consider the question of distributing high tension arc light currents the gravest and most serious case we have to consider. The distribution of low tension incandescent current I think we may say has been solved. The Edison Company are doing enough with that to definitely settle the question. They are doing it commercially. When it comes to the distribution of high tension alternate current for incandescent service I am free to say I think it is perfectly practicable and can be made a commercial success. When a man rents an arc light he can rent it for three months and when he ceases to use that light if you do not remove the service entirely from his building, you are simply wasting the power. By running through so many miles of unnecessary wire you are losing money steadily. With incandescent, however, when a man cuts off a current and does not use it in his house, you do not lose anything. You lose a trifle in charging an empty wire, but there is no actual work done on that wire and you lose very little. Now I stand here to-day to say that I think I am perfectly willing to give the benefit of our experience to any member of this association or any electric light association, and will give it free and make no charge for it, for that, I believe, is the object of this association. I will give them any help that I can on this subject—that is, any help that I can give from my experience on the subject of distributing alternating currents, or high potential of one thousand volts. I may say on the subject of arc lighting I cannot tell you anything. I have had no experience. I can only give them what experience I have had with cables generally, and that they are welcome to. I most sincerely hope that this report will not go forth as the voice of this convention. I think the resolution passed last August, stating that the underground work so far was not a success, was an ill-advised one. I believe the time has come when this Association has got to face the music. Underground work will have to be put in, and the sooner you do it, or make some honest effort to do it of yourselves without compulsion, the sooner there will be a let-up on this tremendous public pressure to put them all underground, without reference to circumstances and conditions. In the centre of a crowded city, I think — and no one who has been in Philadelphia, New York or Chicago will deny it—the presence of the poles is a nuisance: they are obstructions and to some extent they are a danger. In small country towns and in outside suburbs, I do not consider that the overhead wires are half as much of a nuisance or a danger as underground wires. Now I want to be thoroughly understood as to what I mean by the danger of a lighting circuit. We have been favored with a large number of communications from a distinguished electrical engineer as to the frightful danger of overhead high tension circuits and he is very anxious to put an apparatus on all such lines which from the moment of the grounding occurring will immediately shut the circuit off. That may be his idea of safety. He wants to do that to protect the

eight or ten line men who are presumably men who understand the danger of their business and will take proper precautions against it. To do that he is willing to risk the lives of the unoffending public who may be jammed in a ferry-slip or in the theatre, or on a large public thoroughfare, or in a railroad station, by having the entire light shut off instantly and left in total darkness. Now that is a form of danger which I think is infinitely greater than the little danger that exists from grounding on a high tension line overhead which is only interfered with by men who know what they are going up those poles to do. For that reason I think that perhaps that as far as we know at present the underground service is perhaps more liable to interruption, but against that we have to set this fact that you need not hesitate on an alternating transformer system, and I am speaking of that entirely now. You can run one of these high tensions grounded. Ferranti in England proposes to do nothing else. Under the transformer system each house is a unit; a man who puts his own wire in a proper condition cannot affect his neighbor. With the arc light system you cannot do that; there may be a break and you will have to let your lights go out. For that reason I propose to leave arc lights out of the question. I have taken up a great deal of your time. I hope I have not been tedious; I wish to put myself straight with gentlemen here who seemed to look upon me as a bitter enemy of the underground system. I am putting up overhead every day, and I do stand ready to put down underground if anybody will pay the price. Mr. Garratt made a point at last convention at New York. When one gentleman stood up and said that perfect insulation has not been discovered, Mr. Garratt said: "Yes, it has, and I have got a piece of it in my pocket now. There it is; pay for it and you will get it." (Mr. Smith here exhibited his pocket-book.) It is purely a question of money, after all.

Mr. LOCKWOOD, of Detroit: I am one of the seven who, in answering the report of the Committee on Underground Wires, answered that we had tried the underground system. I represent the Thomson-Houston Electric Light Company of Detroit, where the underground system was tried for a little more than one year and was discontinued a little over one year ago to-day. Now our current was developed from a Thomson-Houston 30 light machine which would approximate to a current of from 1,800 to 2,000 volts. As Mr. Smith says the question of underground work not exceeding 1,000 volts, is one that I do not think any well posted electrical man present doubts is practicable, consequently the discussion on the former underground system where they use telegraph and telephone wires does not apply to currents of over 1,000 volts. Now I think the report or blank that was sent out by the committee was an exceedingly good one, inasmuch as it focused the question right down to ones that had used currents exceeding 1,000 volts potential, inquiring for what period of time it had been successfully operated. I should like very much to hear from Mr. Johnstone and Prof. Barrett as to what cables are now underground, that are using a current of more than 1,000 volts as to what the potential really is as applied to these conductors, and as to how long they had been in successful operation. I have understood from reports made to this convention by Mr. Sunny and others that a large amount of the wire used here in Chicago was taken out about last fall. I would like to ask if there are any underground wires now in use here in Chicago with a potential exceeding 1,000 volts and beyond that, if there are any in use with a potential exceeding 2,000 that have been in use for any length of time; if so, just the length of wire in use, the potential of the current on it and the time it has been in use. Mr. Johnstone says his company is ready now to guarantee the successful operation of the underground system, and even to give a bond for carrying out that guarantee. I think that shows one thing very plainly, that he has faith in his system; but I do not think the electrical fraternity, when they get a guarantee, feel sure it is going to be carrred out; it certainly shows the faith of the man making it. I should like to get a little information as to what has been actually done.

Prof. BARRETT: We started in to use them about a year or a year and a half ago. I think at that time we put in the Western Electric system, which, I presume, you are all familiar with. Sometimes we run them up to 33 lights and sometimes 18; now we use in that cable—that first plant, I think we put in 12 miles, part of it Western Electric cable, and the balance, six miles long, of kerite. That has been in service about a year and a half. Last year I put in 42 miles of cable, and I sent out and I have got a part of every cable manufactured in the country. I have Vulcanite, Okonite, Kerite, Patterson and Standard cables. I told the gentlemen what I wanted to use this cable for. They made their own price, and I am in the condition of my friend here when he held his pocket-book up, I believe that is the way to get insulation—to pay for it. We have now 55 miles of underground cable to do the lighting service for the city. I think in the matter of high tension, if you will ask Mr. Sunny here he will be prepared to give you more information on that than I can, but from the last report I understand we have somewhere in the neighborhood of 1,200 arc lights, and that wire is all underground, and has been in service for five or six years.

Mr. LYNCH: I would like to ask Prof. Barrett a question. There was a cable taken out about the 1st of October near the McCormick Reaper Building. What cable was that? A cable was taken out on which the city lights were.

Prof. BARRETT: You mean an increase of cable; we substituted larger cable there last fall, and puts more lights on.

Mr. LYNCH: A larger cable or two conductors, which?

Prof. BARRETT: A larger cable and a higher tension.

Mr. LYNCH: You took out the old cable, then?

Prof. BARRETT: Yes, sir; it was taken out because it did not come up to the requirements of the specifications asked for on the original bill.

Mr. B. E. SUNNY, of Chicago: I stated at the Pittsburgh convention, and subsequently at the New York convention, what the condition of affairs was in Chicago with regard to underground cable. At the Pittsburgh convention a year ago, I stated that we were in very bad condition; that we had to throw out entirely two different styles of cable, and have finally put in a cable manufactured by the Western Electric Company here, a lead-covered cable with very thick insulation, an insulation thickness of three-sixteenths of an inch all around the copper conductor. At New York I stated that with six or seven months' experience of a large cable we had but four cases of interruption. One of these cases was a mechanical injury, and two were defects in the cable, and one we could not trace. Since the New York convention to my knowledge, we have had no cause of trouble that could be traced to any imperfection in the cable. We have had some troubles, but they were owing to poor work in making the joints. From a scientific standpoint we are getting along very nicely in the matter of working arc light currents through underground conductors. Prof. Barrett is using a current from his works of about 900 volts; that will be 30 volts for thirty lamps; perhaps he gets as high as 1,200 volts. We put through our cables all the way from 2,000 to 3,000 volts, and sometimes go higher. Of course, I can not say how long the cables that we have now that have been in use for just about a year and have only given us four cases of trouble—I cannot say how long they are going to last, or how long they are going to furnish that satisfactory service; but just at this time they seem to be in first-class condition; they are doing all for us that we expected they would, and we are perfectly satisfied with them. Scientifically it is all right; the only objection we have is a financial one. I made up some figures a few days ago, and I find that it is costing us the difference to furnish this service from underground conductors as compared with aerial conductors about as follows: Circuit reconstruction and maintenance of conduit amounted for three months to $9 610.95 That was for 1,194 lamps for eight hours a day for 90 days, or 959,680 lamp hours. You see the cost of underground conductors is a trifle more than one cent per lamp hour over and above what it would cost on an aerial conductor. Now you will say if we had nothing but aerial contors we would still have the item of circuit reconstruction. This is very true, but I have left out the question of underground conductors so far as the repairs on electrical machinery are concerned. It is no question in our minds at all but that we are put to $200 or $300 expense every month on account of repairs to the electrical apparatus that are made necessary owing to our underground cable, so that I think it is perfectly right to say that if our wires were on poles in the streets the troubles I have enumerated would be eliminated. We figured, therefore, that from a scientific and practical standpoint underground cables are all right. From a financial standpoint they are costing us one cent per lamp hour here more than aerial conductors.

The CHAIRMAN: Does that include the interest on the additional cost of the investment?

Mr. SUNNY: No, sir.

Mr. T. CARPENTER SMITH: I should like to ask Mr. Sunny what rent he is paying per mile for each circuit. He includes in his figures conduit rental. I would like to ask him how the conduits are rented. I know that in one case the conduit rent was such that in three years the company could have owned and put down its own conduits, and a great deal better conduits than they were renting. In comparing these with aerial lines you must get the first cost of aerial and underground lines and the cost of making them. It is not fair to charge the fact that you have to pay a certain price to a ring or board or commissioner, or another owner who has got an exclusive privilege, and compels you to go into it. In our Philadelphia station we had precisely that condition of affairs. We were threatened to have to go into the conduit of a particular company organized by a ring. We fought them and beat them. We mean to get our own conduits, and then we will know what we will have.

Mr. SUNNY: The conduit rent is a thousand dollars per year per duct. The duct will hold three electric light cables. So that the rent per mile for each conductor is about $333.33.

Mr. SMITH: We lay down a 16-duct box, which at that rate would accommodate 50 wires at a cost complete of a little over $5,000 a mile.

Mr. LOCKWOOD: I would like to ask Mr. Sunny about these few troubles which he says they have had within the last year,—whether they were simply troubles with joints or whether they were troubles which necessitated taking out a part of those cables.

Mr. SUNNY: The item of circuit reconstruction which was included in the $9,610, included going over joints in manholes, pulling out some sections of cable, and replacing, taking out and renewing some wires under sidewalk; it included everything that we did with the plant that we could not charge to construction, everything that we did to the plant that did not add to its earning capacity. When we took it six months ago we were in good shape, we were in first-rate shape; all the construction that we ought to have done was done, and from that time on we considered that any charge that we would have to make for reconstruction would be a charge that we could count on having from month to month, as far ahead in the future as we could see.

Mr. LOCKWOOD: I then take it that the record stands that the only experience that has been shown up by any one actually using the high tension currents underground, before our convention, is Mr. Sunny's use of currents exceeding 1,000 volts for a period of about one year.

Mr. SUNNY: Let me correct you, please. The figures I have given you are for the last three months.

Mr. LOCKWOOD: What I am trying to make out is not anything against the underground, but for it; I am trying to bring out the facts. We all know what it costs to keep and maintain an overhead system, and that includes small repairs and replacing wires. Mr. Sunny has been giving us the actual expense of the underground system, and if he will tell us what the rent is we shall be able to make a comparison.

Mr. SUNNY: There are four items: Expense account for 90 days: Circuit reconstruction, $3,105.41; maintenance of conduit, $2,286.54; conduit rent, $3,180; rebate (due to bad service), $789; total, $9,610.95. I might say in this connection that the conduit needs a great deal of attention. It is one of the first ever put down. It was put down five years ago. Street rollers rolling over it have crushed it here and there, and we have had to enlarge some of the manholes. If you put down a conduit as it can be put down to-day it would not cost you as much as that to maintain it. It would not require three or four men going round town every day in the week pumping out the water and drawing out the gas. But this, just as we have it here, is costing us over $2,200 for three months to keep it up. The conduit rent is $3,480, the rebate, on account of bad service or no service, is $789.

Mr. LOCKWOOD: Then I understand that the expense of the maintenance department, including rebates and necessary repairs which every system, whether overhead or underground, must be approximately $6,200 for three months: that during that period Mr. Sunny's company has been having its greatest success with underground wires. I would like to know now if there is any one in the convention who has actually used underground wires with a potential exceeding 1,000 volts, who has a record which makes a better showing of what has been done than this one of Mr. Sunny's.

Mr. E. A SPERRY, of Chicago: This question that has been brought up I might answer in this way: That in the last four years we have been operating on State street here an underground system of 1,800 volts and about 18 to 20 ampères; and entering into the construction of that underground system has been every conceivable kind of cable, as the extension of our lines have, from time to time, required it. First, we used the conduit as fast as it was put in; latterly we have been using iron pipes. I find no trouble in using the iron pipes. As to accurate data with regard to the cost of maintenance of this underground system, I will give it later, but I am not in possession of it now. I do not think, however, that that account, figured in lamp hours, would reach any such point, including rental of conduits, as has been named here. It may be that it is owing to our lines being only about three miles in extent and the station being operated on, of course, a smaller plan than that of the Chicago Arc Light and Power Co. We are operating now another station in the city here with 1,300 volts, with a record of no shut-down whatever, and a record of over a megohm as actual insulating resistance every morning. This latter construction is all underground, as I said, and is made of improved modern cable and is put in iron pipes and under sidewalks and areas. This being more than a thousand volts I think comes under the question.

Mr. LOCKWOOD: As I understand the gentleman he says they have in all about three miles of underground wire and that it has been in use four years. I would ask whether all the wire in use on those short circuits is the wire put in four years ago, or whether it is wire that has been put in in place of the other.

Mr. SPERRY: There has been a great deal of changing, but that was owing to the pioneer work that we had to do. We had to take what we could get. We could not put in half a mile of underground cable that we could not buy. We had to take the best thing in the market and test it. If it did not prove satisfactory we had to pull it out and put in something else. Now the first cables that were used for the first three months undoubtedly are all out. As to the next cables that were put in, parts of them are out. I have in mind now one cable put in three weeks ago that is now running, and running successfully. That is to my mind a very great illustration of what the cable can be made to do if it is properly put in. Extra precautions were taken.

The CHAIRMAN: What electromotive force, please, Mr. Sperry?

Mr. SPERRY: 1,600 and 1,800 volts.

Mr. T. CARPENTER SMITH: Mr. Sunny has stated that his rental of conduits and repairs to conduits amounted together to $5,600. Now he is in the unfortunate position of renting a conduit and then having to pay for it into the bargain, which is precisely the general result where you rent conduits from a company in whose power you are, so to speak. That leaves as the total cost of Mr. Sunny's conduit for underground service, reconstruction, etc., $4,000, or about $1,300 a month. Now, I would like if Mr. Sunny would tell us how many miles of wire to how many miles of conduit. Then we will get at his monthly cost of maintenance per mile of pole-line as against per mile of underground conduit.

Mr. SUNNY: I cannot answer that question with any degree of accuracy, as to how the mileage that we have is divided. Mr. Wilmerding, the superintendent of the company, is here, and perhaps can do so.

Mr. WILMERDING: We made out the total mileage of underground conductors as about 78 miles. There are 90 miles of duct; about 7½ miles of conduit.

Mr. LYNCH: How many wires in each duct?

Mr. WILMERDING: Not more than three.

Mr. LYNCH: I would like to call Mr. Sunny's attention to the following figures: rental of conduits, $3,400 for one quarter; that would be $13,600 per year. That would be 13½ miles of duct at $1,000 per mile per duct. Three miles of duct give only 40 miles of wire. The superintendent, Mr. Wilmerding, just said there were 78 miles of wire underground.

Mr. SUNNY: I asked Mr. Wilmerding if he could give us the division of that mileage, but he did not answer the question. We have 78 miles of circuit, and I should estimate, as Mr. Lynch has suggested, that there are about 40 miles of that circuit in the conduit; the balance is under the sidewalks and in buildings.

Mr. LYNCH: You do not have to pay any rental for the subsidiary ducts which you use—that is in the cellars and over the buildings?

Mr. SUNNY: No, sir.

Mr. CHAS. COOPER, of Brooklyn: While this underground business is very interesting electrically, and we are very glad to hear of the opinions of the electricians on the subject, to the practical operators of electric light plant—and some of the gentlemen may not be aware of the fact that I have the pleasure of representing the largest or one of the largest arc light plants in the United States—it would seem that this question all gets down at present to this, that the experience so far had has not been a very good one, and that the only thing that has been said in favor of the underground system so far has been by men interested in underground conduits or cables, or by our friend, I might say my personal friend, Prof. Barrett, of Chicago, who is in the fortunate position of having the municipality of Chicago to pay his bills. Unfortunately our company has to pay its own bills. Prof. Barrett made some remark about thirteen years' service, eight years' service and five years' service. I think I may say that Mr. Barrett's experience in electric lighting for the city of Chicago does not extend over three years. Is that right, Prof. Barrett?

Prof. BARRETT: Less than that.

Mr. COOPER: Mr. Johnstone, who speaks for the Johnstone underground conduit, has made only one claim so far of a successful conduit; that is, of the one in the city of New York, which has not yet been used. (Laughter.) The experience of New York City so far has been that when his conduit is used, it will be, as the others have been, a failure. There would not have been so much underground conduit put down in the city of New York if it was not for the fact that the company that is putting them down has received many hundred thousand dollars from people who thought there was millions in it. As Mayor Hewitt remarked, the Subway Commission in the city of New York consisted of

four men, who, he supposed, knew as little about electricity as any four men in the city of New York, and he added that he could say so frankly, because he was one of the Commission, and he said that their line was chiefly politics; I believe him. Now, I for one would be very glad indeed to have this system of underground conduit prove a success. I have been in communication with a great many companies indirectly or directly who use an underground conduit for arc light wire. In Brooklyn we are very anxious to do the same. We have a commission in the city of Brooklyn composed of three of our best known professors of electricity, who, I can say, are honest men, appointed by Seth Low, the reform Mayor of the city of Brooklyn. One is Prof. Plympton of the Polytechnic, another Dr. Raymond of the Adelphi Academy, and such men as that. Prof. Plympton traveled all over the world, and going into cities where he was told that it was all underground, came to Chicago, where they did not have an overhead wire—much to his surprise he found that they had more here than they had in Brooklyn! He has traveled in Paris, Berlin, London and every city in the world where he heard they had used the underground system, and, much to his surprise, found that none of them had been in successful operation, and came back, and, like an honest man, made his report to the Mayor of Brooklyn, to the effect that up to the present time there is no system that is of practical use to the arc system of electric lighting. We are fortunate in the fact that we have an honest underground commission. Prof. Barrett has started in the electric light field. We are glad to see him there. Prof. Barrett has the city of Chicago at his back. It is a rich city; it will probably not be so rich when it gets through with this conduit business. (Laughter.) Not that I mean to say that Professor Barrett will not use his best judgment in regard to distributing the funds among his friends, the underground conduit men—our friend, Mr. Johnstone, is a representative—but when they get through with the system, when they have used it a few years, they will do just exactly what the other companies have done in every city on the face of the globe—they will abandon it. You cannot do electric arc lighting and make it a commercial success with underground conduits. (Applause.)

Mr. JOHNSTONE: The only people that are advocating underground operation our learned friend just states, are those that are interested. Why not? The only people who are opposed to it are those who have some money invested in overhead wires, and do not want to take them down. It reduces itself to that fact. I want to tell you a little story that I heard about this astute, wise and honest commissioner of Brooklyn, Prof. Plympton, who is a very talented gentleman, and was sent all over the world. They killed a man in New York on one of those high tension currents that Mr. T. Carpenter Smith speaks about, and the family very properly sued the company, and the coroner subpœnaed every body that had any knowledge on the subject. Prof. Plympton was brought from Brooklyn, and he testified about this wonderful trip, when he could not find anything at all underground in any part of the world. The District Attorney said, "Did you ever go over to Philadelphia?" Mr. Plympton did not know that such a town existed; at least he had not been there. He did not go one hundred miles, though he went three or four thousand. In Philadelphia, if you will permit me, I will tell you a little underground experience that Mr. Lockwood has asked about. When we put this electric light station in operation in 1883, we started with three circuits varying from a mile to a mile and a half in length. We could not find in the market wires that any body would guarantee; but the Benedict & Burnham Manufacturing Company, of Waterbury, Conn., had to put up a plant somewhere in Connecticut, and they started by simply using pure Para rubber insulation. Now it showed as high a resistance as you could imagine, and we thought that we had under the direction of our engineer a wire that would stand almost anything. In the course of three or four months we began to have trouble; we had grounds, we had burnings, we had all sorts of things just as we expected; nevertheless, by means of the accessibility to the wire, we could find out where the trouble was. We kept that up for about three years. Some of that wire was still in use when we were bought out. But the failure was due to the want of experience. We believed that we would reach the point of success, and now there are a large number of thousands of dollars invested in manufacturing underground wire for commercial use. Mr. Cooper prophecies that Prof. Barrett's spending money for the city of Chicago will ultimately result in failure. Pray, how is it that he knows this? He has had no experience.

Mr. COOPER: Past experience.

Mr. JOHNSTONE: Have you had experience?

Mr. COOPER: I say past experience. Mr. President, I should like to ask Mr. Johnstone one question. Can you tell me of any underground system, either the Johnstone system or any other system, using an arc light circuit of 2,000 or 2,200 volts, that has been in successful operation, not three years, but three months?

Mr. JOHNSTONE: The Harlem River Electric Light Company of New York—

Mr. COOPER: I ask you if you have got any such thing in operation.

Mr. JOHNSTONE: Not now. (Laughter.) We have done it. We are putting up in 125th street, New York, something that will show and develop this thing in one month, so that there will be no further questions about it.

Mr. COOPER: We will wait until the end of the month.

Mr. DE CAMP: I want to go back to first principles and make a few remarks on this report. When this report was contemplated blanks were sent out. I conceived it would be very difficult to get answers which would enable that committee to perform a very onerous duty, and enable them to express an opinion as to what had been done without laying themselves open to very severe criticism and prejudice, and I was glad that I was not on that committee. When I was told that they formulated that blank in a manner to get at the real facts, and not an expression of opinion, I thought that was the proper way to do it. The criticism has been made rather unfavorably to the report on first blush that it had been sent to one thousand companies without special reference to the companies that were using underground wires as being the only ones who could express an opinion or give an experience. That some gentleman may not be misled by that I will state that the committee, in order to cover the line of duty laid out for them, had to address those who had, or had not, had any experience in that direction. The number who responded was comparatively small, In my judgment that is an evidence of the good, hard, practical common sense that has got into the heads of the electric lighting man. I think that a man is an egregious fool at this late day who will spend hundreds of thousands of dollars to try over again anything that I and seven other men have failed in absolutely. (Applause.) There is no business common sense in that. Now I am going to say what you in this convention have heard me reiterate time and time again. There are three things connected with this underground business; first, insulation; second, some method of distributing your business, and after that is accomplished, third, is it a commercial success? Now there are three things that you have got to deal with, and until you have exhausted them you have no need to bother your heads about anything else. Now comes first the perfect insulation. Mr. Smith holds out from his pocket an insulation which will answer the purpose. Where is the man that says "What will that cable or wire cost when that perfect insulation is put on it?" I have never yet heard an estimate of it. Now the distribution of it by some properly constructed conduit comes next when that is secured. I want to reiterate again what I said in New York. So far as my knowledge goes of general construction, the plan for distribution of wires by the conduit in which Mr. Johnstone is so greatly interested is as good as, and, I am prepared to say, better, than anything I have seen, because I have used it. I do not agree with him as to its being of iron, but that is a collateral question, that is incidental to the other things; it can be made out of anything. Now to come down to the financial success of it, the statement was made to me yesterday substantially the same as Mr. Sunny made here to-day, as being the experience of that company. I said, "That must be wrong; one cent an hour added to the cost of lights must be wrong; that exceeds anything that I could ever imagine connected with it if it was worth doing at all." I thought we ought to be wise enough to stop short of incurring any such expense as this, and I did not take the risk of fixing that in my mind until I had the opportunity of asking Mr. Sunny whether my understanding of that was correct. He told me it was substantially correct, and he reiterates that statement on the floor of the convention to-day. Now what does that mean? Mr. Sunny's experience was an average of eight hours per day in the twenty-four; that is a very favorable record. It is less than we had in Philadelphia. Our average is something over eleven hours; that means eleven cents a day. Now I have been in the electric lighting business a long time, and I do not think we could get, or that anybody else could get, a dollar of capital into that business on any such representations of cost as that, because there are other costs which are very large and which you always have with you.

Now Mr. Johnstone seems to refer back to Philadelphia because he has no other place to go to, and while I regret that I am dragged into that subject, I am compelled to answer it or admit it by silence. I do not propose to admit it. Mr. Johnstone had been manager of that company, I will venture to say, spending one day in the week perhaps in looking after the details of the station, and the other six days galivanting over the country advancing the interests of his conduit company. I will go further from the experience of that company as shown by its books after I got hold of them. Mr. Johnstone goes on and makes his statement about our buying that company out. I will make no reference to that any further than to say that he sold it out at about ten times its intrinsic value. (Laughter.) If I wanted to make a sale of anything that had no value I could afford to give Mr. Johnstone a good round commission. When I went into that station I accepted it just as if it was not worth while to do anything else, but I had never had anything to do except to look after the interests of my superiors, my directors. It was my duty to keep them advised as to what were the needs of the business, and at the same time make as much money for them as I could. I accepted the condition of that station as it was. I accepted without question the statements made as to what was possible with that station. I said: "Now here, there is no further use for my accepting the statements; I have the facilities at hand to see whether this thing can be made to pay on the basis on which I have been educated to consider things as paying." There were no records of that institution so far as its internal operation was concerned that were worth anything. The records I referred to were simply the financial records of the company. Everything was reported, so far as the circuits and conduits were concerned as being in fairly good order; that there were some defects owing to the embarrassed condition of the company, that they had not made any money, never had any money, and consequently were using makeshifts, which is hardly in accordance with Mr. Johnstone's representations as to the financial prosperity of that company. Well, as I said, we made the best of what we had. We were running a blower; it costs some money to run it. Can it be dispensed with? No, that cannot be dispensed with, because of the liability of gas to accumulate in the conduit. What harm does gas do if it does accumulate in the conduit? Let it be there. Well, we have an explosion. What is the cause of the explosion? Defect in the wires, reported in fairly good condition; defects in the insulation causing a spark, and the spark causing an explosion. That does not speak well for the perfect insulation and perfect state of underground wire, and that was a sufficient reason for the continued expense of running a blower, small as it was, and it was run. Further effort was made to ventilate the conduit, to improve it. Then it was reported that there was no evidence of gas. We ran it probably five or six months with from 100 to 125 or 130 lights, a short circuit, with the station expenses so far as the station itself was concerned down to a minimum, and when I say a minimum I mean it because in point of fact there were a great many little expenses that were eliminated from that station by reason of my connection with some other companies which I made useful in that and did not charge them with. But with the 100 to 130 lights, and 130 was the highest that was ever run from the station, and those were twelve o'clock lights, only the one kind, the company did not pay its expenses. I am only mentioning this now to show you that there was no financial success in that particular instance. I will also say that there were from six to fifteen explosions of greater or less degree in these dates. Nothing having happened to seriously injure the property of the company the record was not kept very closely, but after the condition of the conduit was reported to me as being in such a shape that there was no liability to those explosions, we had one. That was got out of very cheaply; we settled the damages for, I think, $260, and I considered that we were very fortunate. Now, that is the history of the Philadelphia company which Mr. Johnstone quotes, and the only thing that he has to quote. Now, for that reason, as every gentleman in this convention who runs a station knows, I might say, from the persecution that they are subject to from any little thing that happens, mulcting them in heavy damages with no compensating profit to justify it, I did what I think any gentleman in this convention would do. I went to the directors and said: "We can survive under this thing with an object in view, but the chances of success, the pecuniary remuneration, does not justify us in taking the risk." They followed my suggestion and we abandoned the arc light business there.

We took up then what came next. We were not in the incandescent business, but we had that elephant on our hands. What were we going to do with it? Suppose we take up the question of incandescent lighting on a small scale and see if we cannot get some knowledge of our own out of that experience. So a given amount of money was appropriated to enable us to put in an incandescent plant, a small plant, and run it and gain our experience. The amount of money expended directly in that one object exceeded by a few hundred dollars what I estimated it to be, and I estimated it as I thought correctly. But two and a half times as much was spent for what I had no idea would arise in expenses; that is, we found that the whole of these conduits from one end to the other were broken and smashed up so that we could not get anywhere through them on account of these explosions that had taken place in them from accumulated gases caused by defective insulation in these perfect wires. Now that is the whole thing to come right straight down to it, and two and a half times as much money was required to be spent before we could put into anything like decent operation our experimental incandescent station. That station was also run at a loss. When I got at the books and got down to hard pan, I charged to profit and loss $46,000 as the accumulations of deficit of five years; there was no other place that you could put it. Furthermore, it ought to have been twice that, but I could not do that because that would have wiped us out of existence. I knew we had no real existence as a company, but I felt it my bounden duty to keep an existence on paper, and that is about where we stand to-day in that particular company. I do not know much outside of the electric light business. That has absorbed my whole attention, but in order to strengthen my position in this I am bound to draw a comparison to show whether I know what I am talking about in relation to that particular company or whether Mr. Johnstone knows what he is talking about. I had no interest at stake there except to make that station a success by any means within my power. It would have been a feather in my cap to do so, and I would have been paid for it, but to-day I have not been paid anything. I have not the cheek to ask them to pay me anything for running a station at a loss, whether it is my fault or not.

The capital of that company is $500,000; it is blocked out for 100 lights; there remains in the treasury of the company a little more than half the stock. Now, I do not propose to stand up and be knocked down on an argument of buncombe, and I think I can stand on this floor and maintain the respect and consideration of this convention. I say that when my statement as to that particular company comes up, as against the statement made on the other side, I am going to leave it for this convention to decide.

Now as to the comparative cost of operating wires underground or overhead. The late chairman of this convention took the wind out of my sails in one of the earlier meetings by bluffing me off when I made a statement as to the cost of maintenance of overhead wires. I did not have the spunk to stand up to that thing, although I believed myself right at the time, but I accredited him with a superior knowledge which I do not believe now that he had. Now leaving out this very mooted question of rented conduit, whether you rent from a conduit company or put down the conduit yourself, and that is a question that is always with you—you cannot get rid of it—I make this statement here, that the cost of maintaining overhead circuits from one station running about eleven hundred lights, exclusively on overhead wires for the year 1888, was 82-100ths of a cent per lamp hour burned. In that I do not include the labor item. I have taken that out and I have made a calculation, and I will make a statement here which you can rely upon as being correct, and within the possibilities of every electric light station in the country doing business in a large city. I have taken the labor of linemen, not one-third of whose time is probably engaged on this particular work, and charged it to that particular item; it is 1.76 per cent. of the cost of the lights. Mr. Sunny's statement of these costs within the last three months, as he puts it, is very nearly three times the cost for the whole year of 1888 of that station. Now, there is nothing left out of that, not one thing. I will be obliged to any gentleman to go over my books and show me where I have left anything out. About fifty miles of that wire embraced in this maintenance account was put up in the summer of 1881, and I am entirely within bounds when I say there has not been five miles of that wire abandoned or replaced. It is just as good to-day as it was when it was put up. The tests that are made from day to day as to the insulation of those wires are just as good; they come and they go; they do not stay long with us. On the contrary, we have had a ground on our underground station, on this miserable low potential current, that has been there a week, and we cannot find it. It is playing hide and seek with us all the time. A statement was made last August in New York that was so supremely ridiculous to me that I thought I did not understand it. In the first place they put down a long stretch of continuous conduits right along beside subsidiary conduits. Now, why do they call those main subways, trunk lines? What on earth is the use of them I do not know; if the conduit is useful for anything as a subsidiary conduit it is good for a trunk-line; but I can see one idea in it. The statement was made that in a duct of two and a half inches you could put eight wires. Every man in this convention that knows anything about it knows that that is an extreme statement. Mr. Lynch informs me that the subway commission only allows three and Mr. Sunny says that three is all that he gets in. When I went over the figures in the city of New York as to the cost of that thing, and figured up that sort of a rental and gave the companies there the benefit of being vastly smarter than I am in piling the lights up, it was costing them at the rate of about eighteen cents a light. Now in addition to that we have got to pay a corresponding rental for our subsidiary conduits. That is the way that stands, as I under-

stand it. Now in this whole system of subway conduit the electric light companies have had sufficient experience to make them cautious; they want a reasonable assurance that a thing will be reasonably successful and give them a fair return before they put in their money. In Philadelphia to-day the arc light business is practically at a standstill because of this agitation on the subject of overhead wires. Philadelphia is practically stopped in the extension of its business. New York has stopped in the extension of its business on account of this subway question. The business here in Chicago, I will assert, is infinitely smaller than it would be if the light companies had the facilities for running their wires overhead, and so it is all over the country. Now the business in Philadelphia and in New York in proportion to the demand for it is a small business. It is essentially a business of progression or retrogression; there is no standstill to it, and the men who have got their money invested in these companies see their salvation in the extension of business. They are broad men, and I think, as I have said before, that there are better men back of the electric lighting interest than ever went into any new enterprise, financially and from every other standpoint. Now it will not do for anybody to say that all these companies do not want a thing and will not put their money into it. They would put their money in mighty quick if they saw a chance of getting it out just the same as they did in the first place. What was the condition of the New York company, the Baltimore company or the Philadelphia company when they started? They were very much alike. The Philadelphia company was started in 1881 by a concession from the council that they would allow them to occupy one street on condition that they light that street for one year without cost, so that the city might determine whether electric lighting was practicable and a desirable thing to have. By the time that plant was completed and was run one year there was nearly $200,000 in solid cash put in; that was eight years ago, when we had nothing to fall back upon; a man had to take his own risk; if there had been a failure the investment would not have been worth anything. There was pretty much the same condition in Baltimore; capital came into it with just those sort of risks; it was a hard struggle, and with all the advantages of overhead wires to bring order out of chaos until they got it on to a basis where it was a fairly paying business if properly and carefully managed. Now that same element is in the electric lighting business everywhere. I can go and raise all the capital that is necessary to put our wires underground if I can show that there is a fair and reasonable chance of success, but I say to-day I have not seen it. Now I will go anywhere to look at these things, but when I go I must have more than my own opportunity of looking at them. I do not want anything covered; that has been my unfortunate experience where I have looked into these underground services; they have shown me all the good points. About the underground wires or overhead wires there is a good deal that you know that outside parties cannot see. Now that is the difficulty of getting information. Take the case of our underground circuits on Chestnut street, the cost of running those wires and keeping them in order. We are going to keep them in order; we have no bad wire in it; we have modern wire in it, and what I selected at the time as the best in the market. The constant attendance on those wires and keeping them in order is way out of proportion to anything we ever experienced on the worst overhead wires we ever had.

Now I will go back to the question here, the question of perfect insulation, and when I say perfect insulation, I mean such that we can handle with the same facilities, without interruption to our business, as we can on an overhead wire. The economical construction of the conduit can be safely left to ingenious minds. I am perfectly willing to leave it there, but I claim that so far as we have gone now, from a financial standpoint it has been demonstrated beyond question that underground wires are impracticable. I do not think we can take that thing up and consider it until somebody comes forward and presents the insulation that I speak of, and tells us what it is going to cost. What is the use of talking about that sort of thing? That is where we stand now in regard to the risks. There is a very exaggerated idea about the risks of electric light wires of any kind; but when the organizations that have this matter at heart collect the statistics the public mind will be disabused of this idea. But there is a danger connected with underground wires which does not exist with overhead wires. Underground circuits must have a terminal somewhere; and the risks of that current are very much greater underground than overhead. We have a circuit underground on North Broad street. It is not ours; it was put there and is maintained by a gentleman who thinks he knows a good deal more about it than we do, and we are perfectly willing that he should think so, and, still, on a damp night or a night that was not very damp, I have repeatedly said to the men, "If there is anything out of order on these lamps let them stay out; it is not safe to go on these poles." That is what is called perfectly insulated underground wire. I do not think that fills the bill—that is where the risk comes in, and that is probably an important thing that we will come to later on.

Mr. T. C. SMITH: I think it is apparent that a great deal of this talk is simply a rehash of what has been gone over at every convention. On the one side we have the underground men to say that the overhead wire is no good, and on the other side the overhead men to say that it is the only thing. It seems to me the only reliable information we have received to-day is that from Mr. Sunny. He has told us exactly what it has cost him; he has given us the items and told us what his success has been, and I would therefore suggest an amendment to the motion, which was made, I believe, for the adoption of the report.

The CHAIRMAN: There is no such motion. The report is before you; any motion in regard to it is in order.

Mr. SMITH: I move that the report be received and be printed, but that it is the sense of this convention that it is not yet in a position to make any recommendation as to the feasibility or practicability of underground conduits, but that it continues the committee for the purpose of getting further information.

The CHAIRMAN: Allow the chair to suggest to the gentleman to reduce his resolution to writing, and put it in the secretary's hands.

Mr. LYNCH: The committee has not expressed any opinion at all. They have simply reported facts as taken from the written answers.

Prof. BARRETT: I will only take a few minutes time. This subject is quite familiar to me. About 5 years ago I had occasion to discuss the underground circuit as applicable to the city of Chicago. I wrote to one of my friends, Mr. Morrison, and Mr. Morrison replied that the only objection he had to it was the earth current. What sounds familiar to me to-day is the fact that when the matter was being discussed before our electric statisticians and experts here from all parts of the country, the earth current entered into it, perfect insulation was impossible. At that time our city authorities thought well enough of it to pass an ordinance compelling all wires to go under ground. I think the first electric light that was ever on exhibition here was handled by myself for the city—a little two-light Brush machine up here on the north side at the waterworks. I never saw one before. While experimenting with the machine I discovered that the current was a pretty stiff thing to go against, and impressed on the members of the council that what in my opinion was the dangerous thing was to permit electric light wires to be strung in our streets and alleys. I found that that was a safe precaution to take. The fire departments through the country invariably insist upon the removal of these wires. You cannot get as good service out of the fire department if they know they have a line of wire with a current on to deal with. I am not discussing this matter now on a financial basis, but as the representative of the people to protect the people Therefore we have never had an overhead electric light line in Chicago. There are times here in the winter when it is impracticable to open up the streets, and then when a local company desires to go across a street or alley, I assume the responsibility to give them a temporary permit to go there; but no company has a right to erect and maintain electric light poles in the city of Chicago. When Prof. Plympton were here first I detailed one of my assistants to show him what we had, and he reported back that there were no wires underground here—that everything was on poles; but at that time we had removed about 2,800 miles of wire from our streets, and eleven or twelve hundred poles. The last time he came out here I took him in charge and said to him, "Professor, don't make that report when you go home again, or I will take a derrick and put you into a man-hole," and I don't think he made as stiff a report in regard to underground wires when he went back. As to the cost of construction of underground service I think it can be done to-day at about 35 per cent. of the cost as it would be when the original plant was put in. If you look at our streets you will find we have about 300 street lights here on fairly good looking posts, wires all underground, substantial conduits, and they stand us in about $300 apiece as they stand on the streets. The cost to maintain them is simply nothing.

Mr. MORRISON: How many lights are being run by the city?

Prof. BARRETT: We had 285 in service last night that belong to the city, with a capacity of 500 as soon as our finances permit us to extend it.

Mr. E. R. WEEKS: What E. M. F. do you use?

Prof. BARRETT: I think about 1,000 volts.

Mr. WEEKS: You have been working one year, have you?

Prof. BARRETT: I have been working one year and a half with 104 of these lights, and last year we introduced the balance of them. Now, this is a subject in which I have not a great deal of interest except to be prepared, as I am prepared, to show you conclusively what I am doing here. We have a variety of construction; we embrace the Johnstone, the Dorsett, the Phipps, and iron pipes and wooden boxes, and almost everything that is in the market. We have given them all an opportunity, and they all do well. We do so also with the cables, and we have as good a line of service I think with the cables as any line on the earth.

Mr. F. RIDLON, of Boston: We have had one difficulty in Boston with the underground service which does not seem to have been touched upon at all. We were very much surprised a few weeks ago to have the insurance people intimate to us that they would have to increase our insurance, because of electric lighting, as they considered it an extra hazardous risk. This was striking us right home. We felt that it was necessary to know the reason of it as they had heretofore expressed the utmost confidence in electricity as an illuminatant, and considered it the safest method of illumination. It became necessary to inquire and see what the difficulty was and where it orginated. On investigation we got the representatives of the insurance companies together, their experts and their inspectors and the electric light people, and their statement was that there had been within the past six months a large increase in the fires in the city of Boston occasioned by electricity or electric light wires. We investigated each one and found that a very large proportion of these fires had been caused by the underground service which had been in operation about one year, perhaps a little longer. The amount of underground wire was perhaps between 40 and 50 miles. We have nearly 600 miles of the overhead wire in Boston, and perhaps two or three hundred miles of it has been in operation some five or six years, perhaps nearly seven. The alarming increase of these fires has been within the past eight months, much more than equaling all the fires and causing a loss which was quite a large amount, whereas in the previous five years of overhead lighting insurance companies had not paid one dollar of loss. It became necessary to investigate this thing closely, and it finally proved that eight out of ten of these fires were caused by the underground service, and it is now quite a question whether we can afford to continue the service which was found to be an extra hazardous risk, and have to pay more for our lighting, or else we are liable to lose our insurance.

Mr. WEEKS: I will not take the time of the convention stating my views in regard to this question, as they have been pretty well presented on former occasions. I would like to read a couple of letters from two electricians who are well-known not only in America, but throughout the world—letters addressed to the editor of a paper who had been enterprising enough, and considerate enough, to apply to the proper parties for information in regard to this subject. The first is from William Hochhausen, of New York, addressed to the editor of the Kansas City *Globe*. The second is from Prof. Elihu Thomson to the editor of the *Globe*. Mr. Weeks then read the letters referred to.

NEW YORK, Feb. 6.

To the Editor of the Globe:

In relation to the question of the feasibility of using underground conductors, it must be confessed that very little experience has been had, as yet, with such conductors for the convenience of high-tension arc-light currents. Chicago has probably been wired underground for such purposes to a larger extent than any other city in the United States. These installations are of such recent date that it would be premature to pronounce them an assured success. It would seem advisable to watch the working of existing underground circuits for a few years before attempting to enforce burial of a great number of circuits. If roomy, well ventilated subterranean passages were provided for the reception of the electric wires by the municipalities it might be possible for the arc light companies to give satisfactory service, but such structures are very expensive and would certainly be beyond the means of electric light companies. A wire, merely buried, when insulated as well as our present knowledge of insulating substances will enable us to do, would be liable to give trouble and necessitate the repeated digging up of the streets to effect repairs. The overturning of the soil in city streets will generally cause miasmatic exhalations and should be prevented as much as possible. It seems that New Orleans will shortly try a system of running wires at a very high elevation, fastened to substantial iron structures placed at street intersections. This plan is likely to prove very successful. This undertaking should be watched with interest by all corporations contemplating a removal of pole lines. WM. HOCHHAUSEN.

LYNN, Mass., Feb. 10.

To the Editor of the Globe:

It is difficult to formulate any opinion which will apply, without exception, to every instance of wiring. While considerable objection can undoubtedly be urged against the use of overhead wires, particularly as they are frequently installed in electric signaling, telephone and electric light work, objections may also, with equal force, be raised against any system of subways thus far put down. Without doubt the most satisfactory subway arrangement would be to have a sufficiently large tunnel for the passage of workmen, with means for supporting the wires on the sides and roof, thorough ventilation of the subway being always maintained. This would be, however, enormously expensive in most cases, and except for the main thoroughfares of a large city, the expense may be considered to be prohibitive. The difficulty is not so great in dealing with the wires in the main streets, which probably could be put underground whenever the expense was not too great. But the real difficulties are met in minor ramifications which would be needed to reach customers at various points.

The problem of preserving the insulation of underground wires which are exposed to emanations of the soil, leaks of coal gas, steam, etc., is in itself a serious one, particularly with high potential currents, such as are in use in arc lighting. There would seem to be no reason whatever why telephone and telegraph circuits might not be put underground in suitable subways and the expense would be very much less in proportion than in the case of electric light wires. This would remove a very large portion of the overhead wiring, and also that portion consisting of bare wires and innumerable dead wires of telephone and other circuits, as it frequently does not pay to take down a wire when it becomes disused. This is not the case with electric lighting wires, which are not liable to become dead wires at any time, and which, when grounded or defectively supported, at once give notice of the fact by causing trouble in the system. Most of the crosses and leaks on electric light circuits are without doubt caused by the frail, uninsulated, rough surfaced wires of telegraph and telephone systems falling down upon the electric light wires.

It is my opinion that legislation would succeed best in the undertaking of removing the overhead wire nuisance, for such it undoubtedly is, by a gradual process, first getting those wires underground which can without doubt be put there with an increase of security and certainty of service, as in the case of telephone and telegraph circuits within the limits of a city. What wires are then allowed to remain overhead should be taken care of by enforcing a system of skilled supervision in the placing of them, prohibiting the irregular and random running of wires from point to point and requiring that an orderly system or plan should be observed, the purpose of which would be to keep the wires together and to allow branches and crossings only at right angles, on neatly constructed and well supported structures. It should also be required that a sufficiently large and strong wire be used so as to resist the action of wind storms and sleet storms.

I think that in many instances the enforced resort to subways, especially such as might be and such as have been constructed by parties having little acquaintance with the nature of the problems to be solved, such as subway companies securing a franchise for such work, and proceeding on such an economical basis that poor construction and unskilled supervision are made to take the place of first-class work, would be a damage to the business of electric lighting, and would, in fact, act as an insuperable barrier to the undertaking of business in quarters which cannot be reached cheaply and easily by overhead construction. In many cases subway construction requiring an outlay which would far more than counterbalance any return from the business itself would be necessitated."

The remarks I have made apply particularly to large cities. For towns of very moderate size I can see no reason why overhead wiring, properly looked after, properly organized and systematized, would not be comparatively free from objections, while the expense of construction of subways would be so great as to render electric lighting or telephone work worse than unremunerative. The location of subscribers and users of telephones and electric lights are apt to change from time to time or from year to year, and this is particularly the case in the smaller towns. Oftentimes the different users are at considerable distances apart, and changes of location often would involve the giving up of portions of a subway or underground wire system and would in this way lead to greater losses of capital. In the denser part of cities this objection does not hold good because of an average sufficiency of users or consumers in such districts.

Oftentimes, in order to make a business a success, even in cities of dense population, it would be necessary for an electric light company to secure contracts for a period of years, as in this way only could it be guaranteed against loss in the installation of a system of wiring, involving the introduction of underground lines which, to be placed, would require the digging up of the streets, etc.

I am, however, heartily in accord with any measure which does not deal with this case of overhead wires blindly, but takes up the question in a fair-minded spirit, with a clear-sighted judgment of the difficulties of the undertaking. A continued experience tends to confirm me in the opinion that the proper way to deal with the question is to first dispose of those wires which can be buried without detriment and without prohibitive cost, which action would be followed by the gradual elimination of others wherever it is feasible and where the circumstances are such that this can be done without the destruction of business interests involved. A plan of reorganization of the wiring under strict rules as suggested above would, I think, suffice for the remainder of the overhead work.

When this is done our cities would be free from the immense tangle of wires covering the streets and buildings, passing from point to point in every conceivable direction vertically, horizontally and in every other way, which wires have been installed at the caprice of linemen whose only desire has been to get through their task as quickly as possible, and who in fact may have been urged to work in this manner by their employers.

ELIHU THOMSON.

The resolution of Mr. Smith was then read by the Secretary, as follows:

Resolved, That the thanks of this association be tendered to the committee for its endeavors and the chair continue and add to that committee Mr. Sunny, Mr. Sperry and Professor Barrett, with a view of obtaining further information, and that the sense of the association is, that it is not yet in a position to make any recommendation for or against the placing of arc light circuits of one thousand volts potential in underground conductors.

Mr. COOPER, of Brooklyn: I offer this as a substitute to

the resolution: The National Electric Light Association does not feel that the experience of which it has knowledge is of such a nature as to justify it in believing that any practical commercial method of putting high tension arc light wires carrying a current of over 1,000 volts underground has been brought to its attention. Seconded.

Mr. ECCLESINE: Having seconded the resolution offered by Mr. Smith, which asks this convention to continue this committee and add to it three names, I, of course, rise to speak against the substitute as one that would give an expression of thought on the part of the association that the committee themselves did not undertake to do. They simply reported the facts that they found. If the committee, after having spent all the time that they did, and after this long debate in the association, was not prepared to express itself on that subject, I think it would be a safer plan to adopt the resolution of Mr. Smith and continue the committee with the additional names, so that when they next report we will have a great deal more information on the subject and can handle it more intelligently.

Mr. COOPER: If at that time there is any knowledge brought to our attention which would justify us in passing a resolution that the conduit system was practicable it would be time then to pass it. That does not apply to the present time.

Dr. MOSES: I have listened very attentively to this exhaustive discussion and declare myself now, as I have always done on the floor of your conventions, in favor of an impartial discussion of facts and an impartial distribution of justice. When we consider that this committee has acted most carefully and laboriously in gathering information and directing its inquiries to a vast number, we feel that they are entitled to our thanks, which we will heartily give. As I understand 1,066 circulars were sent out, directed to all the different enterprises connected with electric lighting in the country. One or two perhaps have not received this circular, but the mass of them have, and have either thought it worthy of reply or have not replied from the fact of not being particularly interested in the subject as yet. I imagine that those who have not replied have been in outlying cities where this subject has not come to their attention, nor is it likely to. The fact is, but seven people have replied to these inquiries. The fact is that only one city in the country has looked into this thing carefully. In view of these facts I think it would be better for us to stay any action on this subject until we have more experience. I am a great believer in letting well enough alone. The electric light interest has grown wonderfully in the last ten years. Agitation on this subject now would tend to check it, and I think it is our duty here to prevent any such agitation. It seems to me that in regarding this underground conduit system, we are somewhat in the position of the British Parliament on one occasion when it summoned before it Mr. Brunel, to give an opinion, when steam traction first began to occupy the English mind, as to what was the most necessary thing to be done, whether they should lay out money on rolling stock, or on a good roadbed. He unhesitatingly said, we ought to put our money at once into an iron rail, and when we have got that we have got something certain; you will find that you may increase your speed enormously. It was done and that was the reason why steam traction spread with such enormous rapidity throughout England and the world. I say the same thing with regard to burying electric light wires. When you are quite sure that you have a system by which electric light wires can be buried, then I say spend all the millions you have lying around and put them there. But until you are sure of your rail, I say it would be folly to put in your insulated wires. They may be of the best character, but first be sure of the receptacle into which they are to be put. Now this question is one that we are to act upon at present. I believe we shall act in the way that Lord Bacon says a judge should not act. He says that those judges who refrain from giving opinions frequently decide. I say let us decide not to decide on this question. Let capital work out its own salvation. If it desires to go into the introduction of conduits when they are ready for use, we will clasp hands with them and lie down with them together. I hope that this substitute will prevail.

Mr. MORRISON: I rise ostensibly to speak to the amendment, but I would ask the permission of the convention to stray away from that and quote a letter which had completely passed out of my mind, and was brought to my attention by the gentleman from Kansas City. The letter was written in response to an inquiry from the editor of the Kansas City *Globe* during the current month. The committee of gentlemen appointed by this association have given to us the best information which they could obtain by correspondence and otherwise. They offer no opinion of their own, but simply offer a compilation of the testimony obtained by them from the sources which they believed to be the most reliable; that is, from those engaged in the electric lighting business. From my standpoint it is perhaps unfortunate that so few practical experiments have been made in the direction of underground lines by those engaged in the electric lighting business. The excuse for that, if excuse you may call it, has been quoted by prominent speakers who have felt the sting of incompetent work in that direction, notably Mr. DeCamp, of Philadelphia. I regret the personal turn that some of these discussions have taken, but I believe that this is one of the most important subjects which we are called upon to face and that we cannot keep it down. It will be brought up every year in your counsels, and I think the convention owes a debt of gratitude to the gentlemen who have composed this committee and have done the best they could. Mr. Smith, of Philadelphia, who always brings to every subject he considers a degree of intelligence not surpassed by any member of this convention, has given you a full and broad statement from his standpoint, and that is the standpoint of experience, the best of teachers, the hardest of masters. There is, however, a point in his statement which needs to be carefully considered. He said he had had no experience with the high tension arc light system, and we all know that it is only within a brief period that we have been able to conduct the low tension systems with any degree of economy or any promise of return for money invested, so that the experience given by Mr. Smith, while it is good as far as it goes, does not cover the domain in which many gentlemen in this association have invested their money and to whom capitalists are looking for a return of the money that they have invested. A subject of this kind cannot be fairly considered nor properly adjusted in a day, much less in the short time allowed on the floor of this convention. This convention is banded together for the purpose of obtaining from year to year such information as the experience of its members can suggest. We are not expected to frame perfect laws, or give information which is infallible. We are only travelers on the road of progress, and as we go along we note each day what we have observed and give it for what it is worth. Professor Barrett alluded to a matter that occurred some fifteen years ago. I think it was in 1874 or 1875, that I was superintendent of the Fire Alarm Telegraph of Baltimore. I was directed by the council of that city to report upon the feasibility and probable cost of placing the wires in that city underground. I had correspondence with every country on the face of the globe where underground wires had been used. A full and exhaustive report was compiled from that correspondence. The result of the information which I was able to gather was that it was perfectly feasible to place such wires underground, and the cost at which that work could be done at that time in Baltimore was named. Among the many pieces of information which I obtained was one from the director general of telegraphs of the German Empire. In the City of Cologne, in the year which my correspondence took place, they dug up a cable that had been made by Siemens Bros., of Berlin, which had been underground and had not been touched for 21 years. They had not lost an hour's time by interruption in that cable and they had not put five cents of repairs on it. They dug it up to put in its place a cable of greater capacity for carrying the current than the one which had been there all those years. The feasibility of placing those wires underground was demonstrated beyond a doubt, because for years and years those wires had been underground and had performed their service properly, and they were continuing from time to time, under the intelligent administration of the German electricians and electrical engineers, to lay additional wires underground, and they are so continuing to this day. So much for the matter that at that time brought Prof. Barrett and myself close together, and which, perhaps, had as much to do with inducing him to enter the field of underground wiring as anything else did. The conditions which governed the laying of telegraph and telephone wires and those which govern the electric lighting business are entirely different; but no one has ever heard me say that it is not feasible to put high tension electric light wires underground. I am not prepared to put myself in that position. On the 5th day of the current month I received a letter from the editor of the Kansas City *Globe* asking me whether in my opinion any satisfactory system had been invented and whether arc electric lights could be placed in a subway with telegraph and telephone wires; also if high pressure electric light companies would be compelled to discontinue business if the underground wire law went into effect. To those questions I made the following reply:

BALTIMORE, Feb. 5.

To the Editor of the Globe:

SIR: It is, in my judgment, possible to construct a subway and to make it available for high as well as low tension systems of electric lighting. Such a subway, however, has never been constructed in this country. The efforts in that direction, notably in New York and Chicago, have succeeded only in crippling the electric light service, preventing the general public from reaping so fully the benefit from it as when the lines are permitted to be used overhead. The demand for subway construction comes, in a general way, from legislatures and citizens who know little or nothing about its requirements or defects. Intelligent legislation cannot be had unless the legislators possess this knowledge or take sufficient time and make sufficient expenditure of money to possess it. For this reason all experiments in this direction should be made at the expense of those desiring it. It is, therefore, my opinion that all subway construction should be done at the expense of the city or State, and when by them completed should be submitted to competent judges as to their availability for the purposes intended. Then introduce the wires in a limited way, that experience may prove the correctness of the system, after which order private companies to place their wires in each conduit, charging a sufficient rental for the same to cover cost of maintenance. I say cost of maintenance, not any part of the cost of construction. It is my opinion that neither the municipal nor State governments should invade the domain of private enterprise for the purpose of making a profit. The citizen has greater stake in the untrammeled use of electricity for light and power than he has in the investment necessary to take the current underground. If this course is adopted by the legislature of Missouri, or any other State, it will not "cripple the arc light companies using high pressure," nor will it "lead to the abandonment of these enterprises."

J. F. MORRISON.

That about covers the ground from my standpoint. I have been familiar with every effort made in the direction of underground wire. I look upon the work done in Chicago as having been, perhaps, under the most intelligent direction of any experiments on this line in the United States, and the story of the result is told by Mr. Sunny in a very conservative way, which has a most telling effect upon the audience that listened to him. He has shown you that the subway system in Chicago is not perfect and shows the tremendous cost entailed in keeping the works in such condition as to enable him to deliver the product of the central station to his customers. I believe those evils can be remedied and some plan be found by which the lines may be carried underground. Until that time comes, no body of men, State legislators or others, have a right to put their hands in your pockets or mine and take from us the result of our labor and invest it in a plant which lessens their taxation and imposes a double burden upon us. I look to such men as Professor Barrett and Mr. Johnstone and the men who are engaged in the manufacture of insulated cables for underground purposes for the solution of this question. It is they who will reap the benefit of these things. Professor Barrett is an officer representing this municipality, and the better service and the beautiful streets which he will have when all these obstructions are removed and the safety to life is such that a man can walk over these subways without being in danger of being blown into the air, is an object to him. It will be a benefit to the electrical manufacturing companies, because of the vast returns which they are bound to gain when this system has been perfected; and that it will be perfected there is not the slightest doubt in my mind, because the overhead wire is not a thing beautiful to the eyes, and it is not safe to human life. Perhaps it is as safe as the other at present. The other will be safer. As I told Mr. Johnstone in Philadelphia, "If you accomplish one part of that which you think you have accomplished, the time will soon come when you will be looked upon, not as a public plunderer seeking to reach into the pockets of capitalists, but as a public benefactor who has earned for himself the right to the gratitude of generations to come."

The question upon the resolution of Mr. Cooper was then put, and a vote taken.

The PRESIDENT: The chair is unable to decide. The secretary will read the substitute again, so that you will all have it in mind. It is competent for any ten members to call for a division or a roll call.

More then ten members called for the roll, and the secretary thereupon called the list of members.

During the calling of the roll, when Mr. De Camp's name was called, a separate vote was recorded for him as the representative of four different companies.

Mr. A. F. MASON, of Boston: I would like to raise a point of order. I want to know what these four votes mean, voted by one man in a body of individuals.

The SECRETARY: Mr. De Camp at various times sent me a communication as general manager for four different corporations, and sent me $80, which I accepted.

Mr. MASON: Does that give him four votes?

The CHAIRMAN: The chair ruled yesterday that the proxy might be received—a proper proxy. Now, the point of order, as I understand it, is, can a gentleman represent four different companies at the same time?

Mr. MASON: No, sir; if you please I will state the question. This is a body of individuals. Can the same individual have four votes because he pays four times the fee of admission? That is the whole question.

Mr. SMITH: I think I can explain that to Dr. Mason. Mr. De Camp has not paid four times the fee, but four different companies have paid a fee, and happen to have settled upon the same individual to represent them.

Mr. MASON: I make the point that this is not a body of companies; it is a body of individuals. I have great faith in the ability of Mr. De Camp to put himself in a good many places, but I have great doubts whether he can be considered as four individualities.

The CHAIRMAN: The chair is very willing, as this is the first time the question has arisen, to listen to the point of order.

Mr. MORRISON: The original constitution of the National Electric Light Association comprised companies, firms and individuals. Under that head the several companies named by the secretary were members of this association, and their membership continued from time to time. Under the head of individuals a change being made, I believe at the last convention, and the interpretation of the constitution being that individual names and not corporate names should represent the association, Mr. De Camp perforce by reason of that peculiar combination of circumstances, which can exist only in Philadelphia, becomes a little more than a trinity, for I think he represents four companies. It is a question which the chair can and must decide now, and involves also a question of principle. I do not believe that Mr. De Camp has a right to vote four times on this question.

Prof. BARRETT: I supposed that this was a convention of individuals; I did not suppose it was a combination of companies. If that is the case it is not necessary for us to be here.

Mr. STEUART: The constitution provides that any member of a company may become a member of the association, and in view of that fact, I cannot see any reason why, if a member of a company does become a member of this association, he cannot equally become a member representing several companies. He represents the company as a member of that company and as an individual member of the association. The fact that he happens to combine the representation of several companies in his own individuality should not deprive him the right which that company has to vote. The matter can be easily adjusted if thought desirable by each company instead of having the same man as its representative sending several men. So that as far as the operation of the thing is concerned, it is as broad as it is long. It is a matter of convenience to let several companies be represented by the same man. Fundamentally I think there is no real error or danger in a man's representing several companies.

Dr. MOSES: While Mr. De Camp has four votes on the side of the question, and in the same direction in which I propose to vote myself, I nevertheless think that the result of a ruling of that kind would be that we would have at our next convention a corporal's guard present. All the electric companies would save the expense, and would send their proxies to the president or to any member of the executive committee in whom they confided, and the matter would come down to this, that we would have very few people attending the conventions. It is a question on which much could be said, but I think that is a light that ought to be thrown upon it.

Mr. DE CAMP: As I do not think that this is the proper time to discuss this question, in view of the question before us now, I will withdraw three votes. (Applause.)

Mr. MORRISON: Is it possible for a proxy to vote, Mr. President?

The CHAIRMAN: The chair is of the opinion, while he has no precedent to guide him in this association, but is a law unto himself, that the proxy is not entitled to vote; that the purpose of this association is to have its membership represented upon its floor. That is the chair's ruling, but the gentleman is entitled to appeal.

The result of the vote was announced as follows:

Total number of votes, 66; against the substitute, 33; for the substitute, 30. The substitute was therefore lost.

The question recurring upon the original resolution of Mr. Smith, Mr. De Camp offered an amendment, adding to the resolution the following words:

"Provided, however, that the passage of this resolution shall be without prejudice to the resolution passed at the meeting held in New York in August last, until a further report is made by that committee."

Mr. DE CAMP: I would like to state my reasons for offering that resolution. I have no intention of shirking the responsibility for continuing that committe as proposed by that resolution, but at the same time, on the very grounds that the gentleman offers the resolution—that is, that that is simply a collation of information from certain companies without really any report of the committee. I believe it was well done; I believe that that is the way to get at it. I am just as much in favor of continuing that committee as any man on this floor; at the same time I want to see by that resolution how much fairness there is in this vote. The suggestion of the vote made and the majority gained is unquestionably by the vote of the people who have an article to sell, which the users say and have declared heretofore that they do not know how to use or cannot use. Now, I am in favor of continuing that committee as proposed there, and I am willing to take the chances of the result of the report that that committee will make at our next meeting to the men whom we are depending upon to supply us with what we want. That is the very thing that we spoke of this morning, and we expect that it will answer our purposes when we put it underground, as the cable that

we have on our poles answers our purpose. Now, I say to the manufacturing companies that is their part of the business. The electric lighting companies have no facilities for manufacturing. They think they know what they want. They ask the manufacturing companies for it and I am perfectly willing to take my chances that as we make ourselves customers of those people, that they in the course of time will furnish us with what we want. But I do think that this vote comes not from that class of people, but from the middlemen, who, I do not think, should decide this question—the men who go between me and the makers from whom I want to buy. If there is any fairness in that vote, they will accept this amendment. I am speaking now of the conduit men, who, I do not think, know anything at all about it. I have a great deal of respect for the judgment of the men who are making the cable, but for the judgment of the others, I have no respect. I do not think they know what we want.

A vote was then taken and the secretary announced the vote as 31 in favor of the amendment and 37 against it. The amendment was therefore lost.

The PRESIDENT: The motion is now on the adoption of the original motion by Mr. Smith.

Mr. G. H. ROE, of San Francisco: There is a little difference of opinion. The convention seems to be divided, and the division is principally between the operating men and the supply men, and it occurred to me if we could arrive at the Scotch verdict of "Not proven," it might facilitate matters. I offer the following resolution: *Resolved*, That while the appliances and devices for operating electric light wires under ground are being continually improved, and promise ultimately to render practical the operating of all electric light wires underground, they have not yet reached such a degree of perfection as would justify this convention in declaring itself in favor of underground wires for central station arc lighting.

The motion was seconded by Mr. Morrison.

Mr. T. CARPENTER SMITH: I would say that in framing my resolution I had endeavored to make it like the Scotch verdict of "not proven"; but to my mind Mr. Roe's resolution amounts to this: "Not guilty, but don't do it again."

Mr. MORRISON: I call for the ayes and noes upon the amendment.

Ten members having risen to support Mr. Morrison's call for the ayes and noes, the President ordered the roll to be called. The roll having been called, the secretary announced that 28 had voted for the amendment and 32 against it.

Mr. STEUART: I call for a new count. We make it two votes the other way.

The PRESIDENT: The chair will appoint two tellers, Mr. De Camp of Philadelphia, and Mr. Ecclesine of New York, and the secretary will call the roll once more upon the amendment.

A new vote was then taken on the amendment; 31 voted aye, and 39 no, and the amendment was declared lost.

Mr. MORRISON: I beg to offer the following resolution, which I am sure every member of this association will vote for:

Resolved, That the original resolution be laid on the table and made the special order of the day for 12 o'clock, Feb. 21.

That refers to the resolution offered by Mr. T. Carpenter Smith.

Mr. SMITH: I would say that I offered the original resolution with the intention of having a fair and square discussion on this point, and of having the association go on without any expression of opinion and to try to secure, if possible, a truly harmonious relation between all its members. As there seems to have been some little personal feeling engendered by this discussion between the supply men and the station men, I think it well to state that I am in favor of accepting Mr. Morrison's resolution instead of my original motion.

Mr. MORRISON: When the vote comes on Mr. Smith's resolution, no one will support it more readily than I. I believe it was written in the proper spirit. I believe it will go a long way toward allaying a peculiar antagonism, which, few of the gentlemen here understand, seems to have originated in this convention. There are some, however, who do. If this matter lies over until 12 o'clock tomorrow, it will give them an opportunity to give this cool and careful consideration, and they will find upon careful consideration that the interests of the electric light man and the supply man are identical, and that any friction between the two classes, no matter how brought about, whether for the advancement of personal ambition or the gratification of caprice, or for the pecuniary benefits of individuals, is bad, and that a victory in any case will be a defeat in the end. (Applause.) This association for all these years has had the most pleasant relations among its members, and this is the first time that ever a difference of opinion has arisen as to the methods of accomplishing the ends which are best for the supply men, and best for the electric light man. Public necessity brought the electric light men into existence. The electric light man brought the supply man into existence. All over this assembly, among the supply men, I find my own personal friends, men with whom I have been associated for many years, and such association is dotted all the way along down the line with the most pleasant recollection. I do not intend to have these pleasant relations disturbed. It is for the purpose of giving cool afterthought to the somewhat heated discussion of to-day that I would move this resolution and ask its adoption, so that time may be given to the men to roll in the snow and cool off. I think the air of Chicago, even if they touch no thing else, will go a long way to cooling the fever that seems to be agitating their blood.

The PRESIDENT: The question is on the adoption of the following resolution:

Resolved, That the resolution be laid on the table and made the special order of the day for 12 o'clock to-morrow, Feb. 21.

The motion was carried. The convention then adjourned till 9:30 A. M. on Thursday.

THURSDAY—MORNING SESSION.

The meeting was called to order by the president at 10:45.

The secretary read a communication from the St. Louis Exposition and Music Hall association, inviting the association to hold its next meeting at St. Louis during the exhibition to begin September 4, 1889. The exhibition is intended to be largely electrical and the free use of the meeting hall was offered to the convention.

On motion, the communication was ordered placed on file.

The following members were then elected:

E. P. Acheson, S. A. Barton, C. F. Dunderdale, H. H. Eustis, A. R. Foote, N. D. C. Hodges, W. J. Johnston, Philip Lange, George M. Phelps, R. F. Ross, C. M. Ransom, Fred H. Whipple, David Stinton, Cincinnati, Ohio; John Kilgore, A. D. Bullock, W. A. Kreidler, J. P. Barrett, Timothy W. Sprague, G. L. Austen.

The Executive Committee, through Mr. Sunny, then submitted the following report:

REPORT OF THE EXECUTIVE COMMITTEE.

At the meeting of the association held in August last, the following resolution was adopted: *Resolved*, That this association shall hereafter have a permanent office in the city of New York, which shall be in charge of an expert electrical engineer, who shall be secretary and treasurer of the association; that the president at once take steps to secure the services of such a person, and establish him in suitable headquarters, and with suitable facilities in this city. The president, acting on the instructions contained in the above resolution, appointed Allan V. Garratt, of Boston, secretary and treasurer of the association, at a salary of $2,000 per year.

The Executive Committee, at a special meeting called in Pittsburgh, Nov. 19, unanimously ratified the appointment and indorsed the action of the president. The Executive Committee has examined the financial report made by the secretary and the work that he has been able to accomplish during the past four months. It is entirely satisfied with the results that have been obtained and unanimously recommends that the office in New York be continued for a further term of six months. While the committee is not unanimous in the opinion that an office in New York can be maintained unless the membership is very largely increased, it is entirely willing to have the experiment tried for six months more, and is very hopeful that the secretary will be able to make the office so successful as to justify its continuance indefinitely.

On the occasion of this convention the Executive Committee has striven, at the suggestion of a number of people, to make an electrical exhibit that would represent as fully as possible the electric light and power service. As has no doubt been observed, many of the manufacturers have gone to a large expense to make the display both complete and instructive. It was decided that in justice to the exhibitors a larger attendance of persons to view the exhibit than was represented in the association ought to be assured, and the committee therefore has sent out about 50,000 invitations, addressing them to persons connected with the management of the large industries and the educational institutions. So far the attendance has been of a character that is encouraging, both to the committee and the exhibitors, and everything points to the accomplishment of the result aimed at—namely, the educating of the general public in the progress in electrical development.

The report of the Executive Committee was adopted.

Mr. STEUART: I have a motion to offer to which I would ask the consideration of the convention. It seems as if the time had come when a nominating committee for the election of officers was an improper method of electing officers to this association. It is necessary for us to-day to elect officers for the ensuing year, and I, therefore, would present a resolution to the effect that the house now go into a committee of the whole for the purpose of nominating officers for the ensuing year. I do this for the reason that the association is so large. There are so many interests involved that it seems to be eminently proper that nominations should be made from the floor and that there should be given full liberality to discussion and competition if there is any. I therefore present that motion at this time, to take effect immediately.

The motion to go into Committee of the Whole for the purpose of nominating officers was carried, and the president appointed Mr. Arthur Steuart chairman of the committee.

The CHAIRMAN: The first thing to be done in preparation of the work of the committee of the whole is to request all those who are not active voting members of the association to retire from the room. It is necessary to do this in order that we may transact this business. It has to be done with closed doors, while we shall be very glad to see all visitors as soon as the committee rises.

A MEMBER: I move the appointment of a sergeant-at-arms.

The motion was carried.

The CHAIRMAN: The chair will appoint Col. Beetle as door-keeper.

Mr. HINE: I beg to nominate for president of the National Electric Light Association for the ensuing term, Mr. Samuel A. Duncan, of Pittsburgh.

The nomination was seconded.

Mr. DUNCAN: Mr. Chairman, while I feel grateful for the compliment intended to be paid in the nomination, I rise, sir, to decline most emphatically the nomination. You have honored me with the position of president for the term of one year. I feel that the action of this association to-day in the report which has been made to it by its Executive Committee showing the financial status and condition of the treasury of the association and the work which is accomplished in a very short space of time is such that it needs no word from me to justify the wisdom of the association in having a separate and distinct officer for that purpose. I have no personal ambition to gratify; I have no enemies whom I desire to punish and no friends to reward. My desire has been from the very first to put this association upon a high plane, and believing that that was the proper way and the only way by which the association could come to a higher and better standing, I suggested that policy. Whether it is right or wrong time will develop and I have no doubt that in the hands of the gentlemen, whoever he may be, whom you select for your president, an honest, fair, straightforward control of this office will be had, and whether it shall demonstrate the wisdom or unwisdom of the course, the trial will vindicate the effort of the association to do what it started out to do. Thanking you for all the courtesies you have extended the chair, I decline the nomination. (Applause.)

Mr. PERRY, of Providence: Mr. Chairman and gentlemen of the Committee. Four years ago, amid much boisterous tumult without and some little trouble within, in this city, in the month of February, was born the National Electric Light Association. Present at that meeting, earnestly working, willing ever to put aside anything that might affect him personally for the good of the association, was a gentleman who is with us to-day and with us at every meeting of the association, one who has been careful and thorough in all investigations, conservative in all his conclusions, honest and conscientious in all his convictions—that gentleman is known to you all; I nominate him for the president of this association the ensuing year—Edwin R. Weeks, of Kansas City.

The nomination was seconded by Mr. De Camp.

Dr. MOSES, New York: I hear several seconds to that nomination; one among them is my own. Therefore, although it seems to be the general desire to second it, I rise to second it in order to be able to add my testimony to that which has been given by Mr. Perry; and also at the same time to premise it by saying that in the declaration of the president, who has just thrown off the toga, we see an act of self-abnegation which deserves our unanimous approval. The action of Mr. Duncan is such as to make us believe that there is a spirit prevading this association which was born with it, has grown with it, and which will continue to live with it—that is, harmonious action for the general advantage of electric lighting interests. Rotation in office has been always a favorite theory in this government, and it is a pleasant thing to see one who has all the elements of success in him and a strong support among the members of this association declining the honor in favor of one whose capability he must recognize and whose friendship, I think, he does possess. I second the motion nominating Mr. Weeks, of Kansas City, also for this reason: He is a man of placid temper, of judicious feeling and inclination, one who is, as he said on a recent occasion, so much in earnest for the development of electric lighting that he has invested every dollar in his possession in it. That is the best guaranty, to my mind, of the earnestness of a worker, when he puts not only his whole soul, but his whole fortune, into its action and development. It gives me great pleasure to second that nomination. I hope that he will be elected. (Applause.)

Mr. MAHER: I rise, Mr. Chairman, to second the nomination of Mr. Weeks and to heartily indorse what has been so gracefully said by both the gentlemen who have preceded me. The Presidency of the National Electric Light Association is an honor that any man might well be proud of; and I am sure that I voice the sentiments of all the gentlemen here present, members of this organization, when I say, that in the choice of Mr. Weeks, we choose one who in all his efforts during the existence of this organization has done much to make it what it is to-day. I heartily indorse and second the nomination of Mr. Weeks. (Applause.)

Mr. COOPER: Mr. Steuart, is it now in order to nominate the First Vice-President of this association?

The CHAIRMAN: The floor is still open for nominations for the President.

Mr. SMITH: I move that the nominations be closed. Agreed.

Mr. COOPER: I move that the nomination for First Vice-President of this association be gone into. I have to propose to this association the name of a gentleman who has long been associated with it in all its work, a gentleman who is well known to all of you, so well known that it is hardly necessary to say a word in his favor. He is a gentleman whom you all know, and whom to know is to esteem him. I nominate Mr. A. J. De Camp, of Philadelphia, for the position of First Vice-President.

Mr. Duncan seconded the nomination.

Mr. RIDLON: It gives me great pleasure to second this motion. Mr. De Camp and myself have, I think, been members of this association from the start. I know of no gentleman who is better qualified by his position in the electric lighting interest than Mr. A. J. DeCamp. I am very glad to second the nomination.

Mr. CRAM, Boston: While I feel that the gentleman who has just been nominated for the position of First Vice-President of this association is so well known to perhaps every member of this association, both personally and by reputation, as an able manager of one of the largest electric lighting companies in the country—a combination I should, perhaps, say of electric lighting companies—that no word is necessary in support of his nomination for the office; nevertheless, it gives me great pleasure to second his nomination, and add this: He is a man who has been strongly identified with the association from its earliest days; an earnest, active and conscientious worker; a large minded, broad man. I heartily second his nomination. (Applause.)

Mr. BIEDLER: Mr. Chairman and Gentlemen of the Association, I have listened with pleasure to all that has been said by my friends, Messrs. Cooper, Ridlon and Cram, in behalf of this nomination for the office of First Vice-President of this association, and it has my unqualified indorsement. I will add, that he possesses, in my opinion, those traits that are covered in a practical, skillful and successful electric light man. He has manifested upon this floor, in the deliberations of this convention, those qualities that eminently fit him and commend him for the first offices in the gift of this association. When we can get such men to accept office they honor us in the acceptance. We can know that those interests which are paramount above all others to this association will be first conserved, and we can confidently feel that comprehensive thought upon the subject drawn from experience and intelligence will encompass all that pertains and may be developed in the science for the practical and general good of electric light and power. I therefore feel a peculiar pleasure in seconding this nomination, and ask at your hands his unanimous election. (Applause.)

Mr. MASON: It is hardly necessary that another should second this nomination, and yet I suppose we would like to go all around the circle and say the words which we all have to say in regard to this nomination; but perhaps for the rest of us it would be best to

> "Let silence covet speech,
> Than vain words clutch for what they cannot reach."

I move that the nominations for First Vice-President be closed.

The motion was duly seconded and unanimously agreed to.

Mr. REDMAN nominated Mr. E. A. Maher, of Albany, for Second Vice-President.

Mr. CURTISS, Cleveland: It gives me great pleasure to second this nomination. I have known Mr. Maher personally for many years. He is one of the oldest and one of the ablest electric light men in this country. I believe that he can bring to this convention an experience that will be beneficial to us all; that he will aid to raise this convention to that point where we all want to see it raised. Not only is he a man of great experience in managing a

company and running a station, but he is a parliamentarian, I believe, the peer of any man on this floor. He is even the peer of our good friend Morrison on my right. [Applause.]

On motion the nominations for Second Vice-President were closed.

Mr. H. M. DAGGETT: If it is now in order I would like to submit a list for members of the Executive Committee of the ensuing year: I would nominate Mr. B. Rhodes, of Niagara Falls; Mr. B. E. Sunny, of Chicago; Mr. Geo. A. Redman, of Rochester: Mr. C. R. Huntley, of Buffalo; Dr. Otto A. Moses, of New York; Mr. E. T. Lynch, Jr., of Brooklyn; Mr. P. H. Alexander, of Boston; Mr. J. F. Morrison, of Baltimore; and Mr. T. Carpenter Smith, of Philadelphia.

Mr. M. J. FRANCISCO: I rise to second the nomination of the gentlemen named by Mr. Daggett for the Executive Committee.

Mr. BROWN, of Chicago: I understand that other nominations for Executive Committee are in order.

The CHAIRMAN: Yes.

Mr. BROWN: I would move that the same ticket be nominated with the substitution for the name of Mr. Sunny of Charles R. Fabian, of Toledo. In doing this, I want to state that my object is to have the Executive Committee consist entirely of central station operating representatives, or at least of those men representing current companies so-called; that is, we should exclude from the Executive Committee all men who are engaged in the supply business or in the manufacturing business. Another reason for substituting Mr. Fabian's name for that of Mr. Sunny is that Mr. Fabian not only has a large electric light plant, but also is a representative gas man. The gas men have on many occasions given membership to electric light men. I do not think the National Electric Light Association have extended equal courtesies to the gas men. Mr. Fabian is not known to most of us, I presume, but whoever does know him, will know him to be a whole-souled, genial man. He expected to be here at this convention and hoped to be, but sent his regrets. He is a member of the association and I hope that his name will be placed on the Executive Committee.

Dr. MOSES: The gentleman has very kindly touched the keynote in the discussion. He has spoken of the necessity of this Executive Committee being composed of men who represent central stations alone. That very thought has been in my mind since the nomination and before. I, myself, do not represent such an institution, and yet I think that this association should be composed, not only of men who represent stations, but all other interests in which electricity plays an important part. Nevertheless, it is my sincere conviction that the ultimate success of this association depends upon its being guided by those who are interested and who represent central station lighting. The whole tendency of the development to-day of this industry is toward the central station. I think the time has come when all inventors are directing their efforts to make their apparatus fit on central station work. If a man has a cigar light, he wants it attached to the central station current distributed throughout the city. If he has a sewing machine or a printing press, he wants it run from a central station.

But I think with us the supplies are as essential as the spirit to employ them. What do the central station people put in operation? That which is brought to them to be used. Who furnishes that? The supply men; yet at the same time, the option of deciding whether to use this or that product or to determine upon the excellencies of them rests solely with the purchaser and that is the electric central station men. Now, this association, as I understand it, has been formed for the purpose of bringing together those employed in central station lighting and other branches of electricity, and those who furnish supplies. It has been successfully done, and I hope that both of these interests will recognize at once their due position. I myself come in somewhat in an intermediate capacity My opinion has been sought frequently by those on both sides, and I feel myself somewhat in a position to give them advice. They have come to me, and in honoring me with this nomination, I look upon myself not in the honorable position that Mr. Francisco put me in as a leader through the difficulties, but as a peacemaker, if I might say so, a lubricant between the upper and the nether mill stone, not of course to be ground, but simply as a lubricator. If it is the opinion of this convention that only one of these interests should be represented upon the Executive Committee, I feel as if I should respectfully withdraw my name from it.

Mr. T. C. SMITH: I feel a little modesty in rising to speak on a nomination for the Executive Committee, having myself been nominated, but I think it due to the convention to state what I think, would be for its best interest, and what I think we will all of us realize in a very short time, and that is the extreme value of Mr. Sunny as a member of the Executive Committeee. (Applause.) He was nominated in New York. I think the first feeling in the minds of those who nominated him was that he was eminently fitted to take his place from his location in Chicago; but I feel free to say for myself, and I think I speak for every other member of the Executive Committee, that it took but one meeting to convince us that his nomination was the right one, because he was the right man in the right place. I should be very sorry indeed to see Mr. Sunny leave the Executive Committee. He is an executive man, and while he does, perhaps, represent a parent company, we must not forget that he represents a very large central station, and a central station that is perhaps unique in the country. For that reason I hope that Mr. Sunny's name will not be withdrawn from that committee.

Mr. S. A. DUNCAN: As chairman of the Executive Committee, I think it is exceedingly important, as this has been mapped out to be an association entirely of central station men, that all systems represented by central station men should have a representation upon that committee, or dual station men representing two systems. I therefore rise to nominate F. A. Cheney, of Elmira, N. Y., as a member of the Executive Committee.

The nomination was seconded.

Mr. MORRISON: Being in the same position as that described by Mr. Smith, having had my name placed in nomination as a member of the Executive Committee, I had intended to sit silent pending the proceedings of this committee. I cannot, however, sit silent and see the possibility of having drift from your active service in the cause of the National Electric Light Association a man so conspicuous for his interest in all electric lighting matters as Mr. B. E. Sunny. Mr. B. E. Sunny is president of the Chicago Arc Light and Power Company. I think that the appointment of Mr. Sunny, by one of the foremost electrical manufacturing companies of this country, showing as it did, that they recognized in him a peculiar fitness for the electrical lighting business, because he had so faithfully and well discharged his duties as president of this company, is or ought to be an additional reason why he should be appointed on this Executive Committee. (Applause). I can add nothing to that which has already been said in regard to the services of Mr. Sunny on the Executive Committee. His services are with us to-day. The perfect appointment of this convention, the vast labor necessary to bring about the condition which you see before you and all that appertains to it,—while due credit must be given to all the electrical people in Chicago, including the chief of the municipal electrical department, yet it is he with whom we have been brought directly in contact, and with whom we have served on the same committee. We stand here witnesses to his great fitness for the place to which he has been nominated. Mr. Sunny has expressed to members of this convention his reluctance in accepting at your hands a nomination for this office, and I for the first time, in my communication with members of this convention, have to learn that there is any objection to his place. The objection made by Mr. Brown, of Chicago, is, in the main, a valid one; and yet, on the the Executive Committee Mr. Sunny is the only exponent of a system that sooner or later we will be compelled to face and which at each convention will be brought up before you, and that I hope to see settled, when some provision will be made to place every electric wire under the surface of the ground. Mr. Sunny has had the handling of an underground plant in Chicago. While in its infancy the effort to improve the service in this direction has met with a great many obstacles, yet he is one of those who has given us more light on the subject that we were able to obtain from any other member of the convention up to the present time. (Applause.) I, for one, believe in going to the shop to get shop information. I believe that to have the best results, this association must be brought in touch with those who handle the specialties by which they carry on their business. I believe that the manufacturers of apparatus, the manufacturers of cables and insulated wires, and those who are spending their time and their money in endeavors to bring about the best plans of placing wires underground, are all valuable aids and adjuncts to this association, and without them your meetings twice a year would be comparatively valueless. Mr. Sunny's experience in this line has given him an advantage over the rest of us who have not had the chances that he had. In that connection I call your attention to the fact that out of a thousand letters written to existing electric lighting companies only seven out of the entire number had had any practical experience in the line in which Mr. Sunny has been engaged, and of that seven men the only one with a sufficiently wide experience to give accurate facts and a hope for the future in that line has been Mr. B. E. Sunny, It is needless for me to speak of his invaluable services to the Electric Light Association. Cool, calm, deliberative, thoroughly posted in his business, I know of no man who could not be better spared from the Executive Committee than Mr. Sunny. I take great pleasure in saying that, while I thank you for the honor you confer upon me in naming me for that position, I would gladly step aside and let Mr. Sunny occupy my place if that be necessary; but with all the testimony of the past years, and especially the past year, I declare that in my opinion you can better spare any member of the Executive Committee than Mr. Sunny, who, at some sacrifice, has allowed his name to be placed in nomination before you to-day. (Applause.)

Prof. BARRETT: In regard to the point made by my friend Mr. Brown, I think, for the general good, it would be a serious mistake to take Mr. Sunny off from the committee.

Mr. FREEMAN: I have been associated with the electric light business for a good many years. I am at present interested in the manufacture of electric light machines. I think it would be a mistake for this association to attempt to restrict its membership to stations, for the reason that the manufacturers should be represented in the Executive Committee to lay before them from time to time the various advances that have been made, and in selecting Mr. Sunny, it is to be said that he represented one of the most active and progressive companies in existence, and should be kept upon that committee representing the manufacturers' interest, and I believe if the manufacturers were all here they would select Mr. Sunny as their representative, and I think it is necessary for us to keep him on that committee.

Mr. A. F. MASON: I regret very much that one element has been introduced into this discussion, and I rise to protest against it with all the force that is in me. The reason stated here for the motion to drop Mr. Sunny and to introduce another name is an outrage to one-half the members of this association, men who do not want and do not ask for any office, but who are told substantially that they can pay their dues and exhibit their goods, but they must understand that they are not of the association, that they are an outside element. I think if that is the fact, the sooner the association is formed upon a different basis the better. This matter has not been introduced by those who are called here by some opprobrious name, "the supply man," but it has been introduced by the electric light men, the central station men, as it is called. If this association is an electric light association, such language ought not to be permitted. If this association is an association of central station plants, let it be so, and be called so.

Personally, I say, it is a grievance to half of the members of the association to be told that they may come here, but should not hold any office in the gift of the association. I earnestly hope that Mr. Sunny's name will be retained on the committee.

Mr. M. J. PERRY: I regret most sincerly that this controversy should have been commenced, but I trust in the interest of peace that it will be terminated at a very early moment. The only objection urged against Mr. Sunny, and I speak with perfect freedom, for my name is not up for any office, is that he has brought to the discharge of his duties honesty of purpose and intelligence of execution. I trust, gentlemen, that the list of names presented for for your consideration by Mr. Daggett will be unanimously adopted by this association, and I move that the nominations for Executive Committee be now closed, and that the list, as it was presented by Mr. Daggett, be unanimously adopted. (Seconded.)

Mr. W. C. KERR: Before that motion is put I would like to make a few remarks with the consent of the gentleman who made the motion.

Mr. PERRY: Very well,

Mr. KERR: The question has been raised here in regard to men engaged in the supplying of apparatus of central stations. The question has been just raised about the disaffection of such men owing to the fact that there is a tendency to look upon this association as a central station body exclusively, in the rather forcible words just used regarding it. I appear purely in the capacity of a man in the electric supply business, that is the steam engine business. I wish to express an opinion quite contrary to that expressed by the last gentleman who spoke on this subject. I believe that this electric light association was organized for the interest of the stations supplying the public with light, and I still believe that that ought to be the main-spring of the association, and that those connected with that department of electric work should manage to control this association, and as a supply man and a member who has been in the past a somewhat active member of the association, I am perfectly willing to relinquish all rights that I have on this floor and say, let this association be run by the men by whom this association was organized and to whom it properly belongs. I speak in this way regarding Mr. Sunny. If a gentleman is connected with a central station he is eligible for an office in this association, of which he is a member. I do not think that he should be debarred from any privileges that he has on that account. He should not be debarred because he is incidentally connected with the manufacturing of some electrical apparatus, which is quite a different ground from that taken by some speakers on the floor. I think that a man's eligibility for office should be determined by a certain position which he may hold and that he should not be disqualified because he happens to be in some other business. I am very sorry that there seems to be a tendency to a dispute between men who sell electric light apparatus and other things connected therewith and those who operate them, and I hope that any such discussion will be avoided. If it is to arise I mean to say, as one of those who are not connected with a central station, that I am very much interested in seeing this association an affair of men who are engaged in supplying light to the public.

The CHAIRMAN: The motion is to close the nominations for the Executive Committee and adopt the original nominations.

Mr. BROWN: Are remarks upon the motion in order?

The CHAIRMAN: Yes.

Mr. BROWN: In making the amendment to the original motion which I did, I had several reasons in mind why it was more proper, as I thought, for me to make that motion than for any one else to make it, and in stating those reasons I think I will explain to Mr. Mason what, it seems, has rather touched him, that I am not a central station man. I am not a man engaged exclusively in selling electric light lamps, but the business of the company which I represent covers not only manufacturing electric light apparatus, but also dealing in supplies. Therefore I thought that it was particularly appropriate that the expression of opinion which I have heard frequently—not on the floor of this convention, but outside—should come from a man who represented the different interests as I do. Another reason why I thought that such a motion as I made was proper as coming from me, was because I am personally acquainted with Mr. Sunny, and it would be understood by every one, I think, that there is no personal objection in my mind to Mr. Sunny. It was simply a matter of policy that I wanted to introduce here. Another reason was that I was on the nominating committee at New York. I was the chairman of that committee, and it was my own motion that Mr. Sunny should be appointed on the Executive Committee and made the chairman of that committee, a position which he has filled to the satisfaction of every one. Another reason was that in a conversation which Mr. Sunny recently had with me, he said his determination, not his desire, was never to serve on the Executive Committee again, and rather laid a blame, if you might call it so, on me for getting him into the position that he had occupied so far. I simply make these remarks in explanation of my amendment to the original motion.

The convention then rose from Committee of the Whole for the nomination of officers, and reported as follows:

President: E. R. Weeks, of Kansas City.
1st Vice-President: A. J. De Camp, of Philadelphia.
2d Vice-President: E. A. Maher, of Albany, N. Y.
Executive Committee: B. Rhodes, of Niagara Falls; B. E. Sunny, of Chicago; C. R. Huntley, of Buffalo; Dr. O. A. Moses, of New York; E. T. Lynch, Jr., of Brooklyn; P. H. Alexander, of New York; J. F. Morrison, of Baltimore; T. Carpenter Smith, of Philadelphia.

The CHAIRMAN: The next business in order, according to the special order of yesterday, is the resolution of Mr. T. C. Smith:

Resolved, That the thanks of the association be extended to the Committee for its endeavors, and that the chair continue and add to the Committee on Conduits and Conductors, Mr. Sunny, Mr. Sperry and Prof. Barrett, with a view to obtain further information, and that the sense of this association is that it is not yet in a position to make any recommendation for or against the placing of arc light circuits of over 1,000 volts potentials on underground conductors.

Mr. SMITH: I rise to speak upon this motion, because I think it right to explain exactly what I wish to accomplish by that motion. I am afraid that I have been misunderstood by the very men whom I wish to benefit—the central station men. I have already had brought to my attention very forcibly within the last year that this association has been getting the name of a packed body of men to oppose underground wires. The moment that that attitude is taken by the public, that moment the central station men find this associatiation of no earthly use to them, but rather a detriment. I introduced that resolution that this convention of this National Electric Light Association might come before the public as a body of men who were willing to consider any question fairly and justly, to examine into it with all the skill and knowledge at their command. I had hoped that the report of this committee coming before us showing the distinct disadvantages of underground wires would enable us to say to the public, "Gentlemen, we are doing the best we can to gain information, and we are honest minded and upright enough to tell you as to the report handed in directly against underground wires that we are not yet in a position to say anything for or against it. "I made the resolution in all honesty of purpose, and I am very sorry to say that I have since learned that it has been used to foment trouble between the central station men

and the supply men. I introduced the resolution for the best good, as it seemed to me, of the National Electric Light Association. I ask the unanimous consent of the convention to withdraw that motion, and I would ask that some central station man who is distinctively a central station man should present it to the convention.

Mr. COOPER seconded the motion.

Leave was unanimously given to Mr. Smith to withdraw his motion.

Mr. MORRISON: In order to dispose of this matter in the way which will bring the best results to the National Electric Light Association, I beg to offer the following resolution:

"*Resolved*, That the report of the Committee on Conduits and Conductors be recommitted to that committee, and that Messrs. Sperry, Barrett and Sunny be added to the committee, and that the committee be continued.

The motion was carried unanimously.

The report of the Committee of the Whole on nominations of officers was unanimously adopted, and on motion of Mr. Morrison the secretary was authorized to cast the ballot of the association for the list of officers and executive committee as reported by the Committee of the Whole.

Mr. MORRISON: I move that the next place of meeting be designated as Niagara Falls at a time in August, which shall be fixed by the Executive Committee, that will best suit collateral circumstances.

The motion of Mr. Morrison was then adopted unanimously and Niagara Falls selected as the next place of meeting.

Mr. S. E. Barton then read the following paper:

ELECTRIC LIGHT STATIONS AS FIRE RISKS.

In the latter part of last year I was informed by your secretary, Dr. Garratt, that at this convention "the subject of insurance in relation to electrically-illuminated buildings, and also the question of electric light stations as fire risks," would receive attention, and I was asked by him to prepare a short paper on one of these subjects. I wish first to acknowledge the honor I feel in being invited to speak before so scientific and large an assembly as this Convention of the National Electric Light Association. Through stress of circumstances my paper will be short, but I wish to touch both subjects in a general way. Insurance companies, like yourselves, sometimes get involved in litigation, and it is my unhappy lot to have been drawn into that unfortunate condition, to the exclusion of almost everything else, for the past two months. I offer this information as a preliminary apology for what may follow. Perhaps my misfortune in being caught in the toils of the law may prove to be your good fortune, because I am full to overflowing on the subject before me.

I cannot refrain, in the outset, from congratulating myself, and my insurance associates in New England, upon the very cordial relations existing between ourselves and the electric lighting interests, and also upon the very favorable experience the underwriters of New England have met with in having comparatively little loss to pay on account of the electric lighting fire hazard. Nor can I refrain from saying that, as favorable as our experience has been in the past, it is being, and will continue to be, made much more favorable through the good work undertaken, and being carried on through the New England Electric Exchange. Its influence and results tend in the right direction—to the education of those employed in the electric lighting pursuits as to what practices and work are safe and what are not, and to the exclusion from such pursuits of any who may, through lack of proper scientific knowledge, be unqualified for the positions they hold.

As a matter of fact, however, I believe that the experience has been, that because men have been required to provide themselves with a license certificate as to their qualification, they have speedily and earnestly set themselves to work to gaining the necessary technical knowledge to qualify them to receive the certificate. It goes without saying, I think, that those men are thereafter more capable in their business, and safer men for all parties concerned than they were before.

At the risk of giving voice to trite expressions, I am going to reassert that I believe we are all agreed that there is no element or force with which we deal that is more capable of self control than the one which called into existence this association, nor is there one prolific of danger or hazard in more ways when unscientifically and carelessly handled.

Now, then, having on the one hand an element so fraught with hazard, and on the other one so easy of control, your duty is obviously to do all you can by your own work to promote and secure safety, and to encourage all feasible plans and efforts of others tending in the same direction. While the plain duty of underwriters in the public interest is first to hold to a strict line of requirements any of you who may be tempted or compelled, through competitive pressure, to depart from what you know are safe practices; and, having done that, the underwriters' duty is not fulfilled until they have indorsed electrical illumination and power by the reduced premium charges that such combined action on the part of electrical and insurance interests is sure to warrant. The two interests are peculiarly identical. Hand in hand they can accomplish much in reducing the enormous fire waste. Disunited and antagonistic to each other, your work will be slower in development. Competition among yourselves and no restraining supervision on our part will drive you to cheaper construction and maintenance of your work. More fire loss and higher premiums for insurance must inevitably be the result, while the public, still calling for your light because it is good, will be deterred to an injurious degree by reason of the increased insurance rates that will surely follow, such as have already been applied in some cases, and threatened in others.

The policy of insurance companies and organizations toward electric lighting, or any hazard, in fact, capable of being minimized, should not be "to fit the punishment to the crime," but rather to lessen the crime, or endeavor to. In your case they will be loth to undertake that policy without your co-operation, and can succeed only with it. Without their co-operation I think you would make but little headway in that direction.

In New England electric lighting is very popular with insurance men, particularly since it has, as applied to some risks, been included in the schedule of "improvements" for which a reduction in tariff is made. The energetic agent in his efforts to scoop in his competitors' pet risks does not fail to recommend the introduction of electric light as a means of procuring a lower rate and securing the risk to himself. He thereby becomes your solicitor. He goes still further: in many cases he manifests his favor to you and serves his own interests by becoming an investor in your apparatus, and a promoter of your industry. Such a condition of things is but the natural outgrowth of a perfect harmony and co-operation between the two great interests. It ought to exist throughout the land.

By reason of faulty work which crept in during the early stages of electric lighting in Boston, numerous small fires which have occurred there have created a scare among insurance men, causing a threatened increase in rates unless a remedy was applied. The following notice, just issued by the Boston Board of Underwriters, indicates where they look to for relief: "At a meeting of the Underwriters' committee, held Jan. 28, 1889, it was voted that on and after May 1, 1889, all electric lighting and wiring companies' men, who are in any way responsible for any of the wiring, running of dynamos, or care and management of batteries for electric lighting, must hold a license from the New England Electric Exchange. This rule applies to isolated plants and central stations alike, and is imperative. No exception to it will be made." Such a rule may seem arbitrary to any one not in sympathy with the objects sought by the "Exchange" (and there will always be found some objectors to any good movement), but after all I believe it is just the medicine needed for the complaint.

In regard to the electric light generating station, the situation is not a pleasing one to either party. Out of over 200 fire insurance companies doing business in Massachusetts, the electric light station is a prohibited risk with all but about 25 or 30 of them. The reasons for this interdiction are chiefly these: First, because electrical apparatus, and dynamos in particular, have been found to be very susceptible to large and uncertain damage in cases of small fires; secondly, because generating stations have too frequently been crowded into very hazardous and improper quarters, simply to get floor space and power at the smallest cost, without regard to permanency and ultimate results; lastly and mainly, because insurance men, as a rule, do not understand the nature of the hazard and often fail to get enlightenment from those in charge of stations. Therefore a large majority of the companies adopt the course of all wise underwriters,—they "take the benefit of the doubt" and leave your station risks alone.

Judging from my own observation of the way in which electric light station risks are peddled about to find takers, and the rates that are charged by reason of there being so few takers, I am led to believe that the question of insurance is to many of you an unsatisfactory one. I cannot help thinking that, even with the present condition of stations as fire risks, if the business as a whole were so classified as to show the aggregate premiums on the one side, and the losses and expenses of doing the business on the other, a fair magin of profit would be shown. But no such general classification or account is made, and the experience of those few companies that venture on your risks, if favorable, is carefully kept to themselves, so that others may not be induced to venture.

Perhaps a bureau of the National Electric Light Association might be formed, the purposes of which would be to collect information as to the aggregate premiums paid and losses incurred in central station insurance. If such a labor should demonstrate that a fair profit remained after deducting gross losses and expenses from gross premiums, probably modified rates and a freer acceptance of the risks would follow. If it demonstrated that the present high rates of premium yielded no profit to those companies insuring your plants, then you would be convinced of something radically wrong, and you would have before you a field for investigationand a work of much needed reformation.

Maybe an Electric Light Mutual Fire Insurance Association would solve the question; but such a step should be taken with caution, and should be guided by those well-founded principles and practices that have proved so successful with the Manufacturers' Mutual Fire Insurance companies of New England, and of which Mr. C. J. H. Woodbury (well known to many of you) is a prominent officer. No risk should be accepted by such an association until improved to a certain standard as a fire risk, and then regular quarterly or tri-yearly inspections should be made, to see that the standard of equipment and care in operation were maintained. Much valuable information as to improved modes of construction and equipment could be disseminated by such an association, or even by your own association.

In some such general way as I have suggested the question of central station insurance can be settled, but while the present tendency to temporary or makeshift installation shall continue, the question will hardly reach a satisfactory solution. Surely the capital invested in generating plants would seem to warrant some general action looking to the standardizing and maintenance of them, and their insurance at a moderate cost.

Mr. MORRISON: I want to add my voice to one particular point. I want particularly to call attention to that part of this very able report in which the lamentable condition of many of the electric light stations of this country, the occupancy by electric light companies of old tumble down buildings or any other place that they can poke apparatus into, at the least cost, is doing more harm to the electric light business than all its antagonists put together. The one declaration made in that paper that the insurance companies of New England have been compelled to abandon the risks of electric lighting stations is a sufficient warning to all those about to engage in that business that the only proper course to pursue is to erect substantial stations under intelligent supervision, and that a law ought to be passed in each State of this Union where electric lighting is proposed, placing such construction under the supervision of the government. The suggestions made in the paper with regard to obtaining such and such information will, I have no doubt, be carefully noted by our secretary, who before this and the next meeting will doubtless, together with other information he expects to gather for us, furnish information on that subject. It is a matter of the greatest importance. It is one that touches your pocket nerve, and when you touch that you touch the most sensitive part of any man who has any capital engaged in the business.

Mr. BARTON: I would like to state still further that it not only touches your pocket, but I am free to suggest it touches my heart to see what I believe to be one of the safest classes of risks that we have (applause) at the present time, through no reasonable excuse whatever, in such a condition that insurance companies will not touch it as a general rule. I believe that in our business generally about twenty-five per cent. of the loss may be charged to what is known with us as moral hazard. I hold that that whole twenty-five per cent. is eliminated from the electric lighting hazard; there is no such thing as moral hazards. (Applause.) Therefore I say when we can have a class of risks with that one risk entirely wiped out, it does seem a shame and a pity that we cannot have the class so raised physically as to make it desirable for insurance companies at low rates. The present condition, is due wholly, I think, to the fact of inconsiderate construction without regard to any permanency of the future condition, but simply to get a station at the least possible first cost. The matter is receiving considerable attention now in New England, and only recently, within the last two weeks, the electric light committee, of which I am the chairman, has been asked by the New England Insurance Exchange to formulate a schedule for the purpose of making tariff rates upon central stations. Heretofore it has been done by the various committees and has been out of the control, or not in the control, of the Electric Lighting Committee in any degree—the question of making rates. They have been rated at what we call the flat method of rating, without any regard to the real merits or demerits of the risk. We are now undertaking to formulate a schedule such as we have been asked to, in which we shall assume a standard model risk at a very low rate. We shall then add in the way of deficiency which we shall make a special charge for those features which we believe contribute to the making of a central station a poor risk, and which can be eliminated by changing, and it will be largely in the method of construction, internal as well as external, of modern fire appliances and of the arranging of switch-boards and things of that kind; so that we hope in a very short time to get a schedule formulated whereby electric light people can have some idea of what we as insurance men think should be done in order to improve your risks, and that will be put into general operation in New England, and I should hope it would spread. I know for certain that New York State and that the New York City associations will adopt it as soon as we have issued it, and therefore it looks as though the insurance of central stations in the eastern part of the country was in a fair way to reach some sort of a solution; but still it lies in your hands, gentlemen, to make it what it should be, and it would remove very largely the feeling or prejudice that usually extends from the insurance companies to the public. When it becomes known, as it is not generally known, that electric light central stations are so hazardous that insurance companies will not touch them, it will only go to increase the public interest against electric lighting in general. They view it from that standpoint that there is something so mysterious and something excessively hazardous about it that they do not want any of it.

Mr. ALEXANDER: I regret very much that the announcement was made that Mr. Barton was to leave early this afternoon. I hope that the subject will be brought up again. I know that Mr. Barton and the insurance inspectors of New England, both of whom are here, have tried to form some worked-out plan for central stations, so that a central station built in that manner should be considered a minimum risk. He had hoped, no doubt, that the association would take this matter up and would aid in perfecting such a plan. This will not be possible in his presence, but the inspectors will remain here, and I hope the paper will be discussed and the side of the central station people will be brought out as well as the other side.

The CHAIRMAN: The point is this: We have a committee, as I understand it, who have asked for time. The chair is not yet informed whether the committee is ready to report; but it was in his mind that the subject would be made the first order of business this afternoon, to be taken up in connection with the report of that committee, thus covering the whole question at one time.

Mr. RIDLON: I beg to substitute Mr. P. H. Alexander, who is president of the New England Exchange, to make that report. He has the data and the material with him on which he can make a report on that.

Mr. ALEXANDER: I shall not be able to make a written report, but I believe that I can state the matter so that the association will understand it.

The PRESIDENT: That being the case, the first order of business this afternoon will be the discussion on Mr. Barton's paper, and the report of the committee on the New England Exchange.

Dr. MOSES: I have in my hand a pamphlet that has been sent to me, and I understand it has been extensively distributed throughout the United States. I will not comment on it beyond merely reading its title, "The Comparative Danger to Life of the Alternating and Continuous Electric Currents." I have read this, and I will not lay the criticisms that this gentleman makes before the body now assembled. Those criticisms are not worthy of notice; but I have a resolution here which I think can express our views, and which I would like to see adopted:

WHEREAS, A certain individual, in order to gratify a personal resentment, has, in exaggerating the dangers of electric currents, striven to influence legislation, so as to cause the introduction of electricity in the form of alternating current as a means of infliction of death on condemned criminals, therefore be it

Resolved, That the National Electric Light Association earnestly protests against those efforts, and unanimously resolves that the members of this body decline to allow any electric current under their control to be used for ignoble purposes.

Mr. MASON: I move the adoption of the resolution.

Prof. BARRETT: I second the motion.

Mr. PHELPS: Would it be in order to move as a substitute that it be laid on the table? I think we had better ignore the pamphlet entirely.

The PRESIDENT: The chair would suggest to allow this matter to go over to the afternoon, when we have a full house. I think it will be well enough to entertain a motion to adjourn and take this up.

Mr. STEUART: I have only to offer a resolution which I am sure you will all accord with, and that is, that we tender to Mr. Barton the thanks of the association for the very excellent paper he has read for us, and that it be accepted and placed upon file among the records of the association.

Mr. JOHNSTONE: I move that Mr. Steuart's motion take precedence over the others.

Mr. PHELPS: I withdraw my motion and will renew it afterwards.

Dr. MOSES: I beg to suspend the resolution I offered in order to pass the resolution by Mr. Steuart, in which I most heartily concur. (The resolution of thanks to Mr. Barton was unanimously adopted.)

Mr. PHELPS: Now I renew my motion to lay this on the table, and, as I said, my purpose is this: I think it would be very unwise for us to pass this resolution. We probably could not better please the author of that book than by passing the resolution. If we disapprove of it we can do it best by silence. That is my view, but I will not argue it now, because you all want to go to dinner.

Dr. MOSES: I will beg to state for that reason I did not state the name of the individual, but the efforts are there. It is quite unnecessary for us to know the name of the man who shoots an arrow at us in the dark if it hits us.

Mr. PHELPS: I think it will be better to withdraw the whole business.

The motion to lay on the table was put and lost, and Dr. Moses' resolution was adopted.

The convention then took a recess until 2 o'clock P. M.

THURSDAY—AFTERNOON SESSION.

The PRESIDENT: The first business in order this afternoon is the report of the Committee on the New England Electric Exchange and the discussion of Mr. Barton's paper on "Insurance."

Mr. ALEXANDER: I am not the chairman of the committee that had the matter in hand, but I was requested by the chairman of the committee the night before last to bring before you this matter of the New England Electric Exchange, with which I have been connected since its inception, and of which I have been the president since its organization. I have not prepared a written report, but as the secretary of the exchange wisely put in some numbers of this paper which contains a stenographic report of the proceedings, I may, with its aid, make the object of the exchange well understood, and the subject may prove interesting to you. In March of last year, that is eleven months ago, there seemed to be a great deal of dissatisfaction expressed at certain insurance rules pertaining to wiring, and in order to see how the electrical fraternity stood on this matter I prepared a circular, which, in common with other gentlemen in the business, I have sent around to every station superintendent and every station company. The circular reads as follows:

"Comments having been made by electric light people

regarding the rules issued by the Insurance Exchange for regulating light installations, it seems desirable that the representatives of electric light companies and superintendents of central stations should meet the electric light committee of the Insurance Exchange and their inspectors to talk over equitable means for harmonizing the object of insurance inspection and the effect of installation of electric light plant." The circular then goes on to call a meeting at a certain time. There was quite a large attendance at the meeting which followed, about 60 or 70 gentlemen being present. A number of electrical matters were discussed and it was finally proposed to form an organization to be called the New England Electric Exchange, which should be, so to say, a mediator between what then seemed to be conflicting interests. The organization was completed by the choice of officers, and right here let me say that in that organization only manufacturing companies and electric light companies were to be admitted to membership. The call read as follows:

"Every one actually engaged in manufacturing or installing electric light and electric power apparatus, or in operating commercially an electric light or power plant, will be eligible to membership in the Exchange."

This comes in part in reflecting upon what was said this morning here regarding the division. We have found it to work admirably there. The manufacturer of electric apparatus is just as much interested, it seems to me, in good electric light installation as the company operating the same. We took the ground that if an engineers' society was formed, a man connecting the steam pipes, and doing that work intelligently, should be considered an engineer just the same as the engineer running the engine, and in fact, as you know, it requires more skill to build an engine than to run it. We did not, however, admit the man that makes the pipe or burns the brick of which the foundation for that engine is built. So we admitted manufacturing companies and companies operating electric stations, but did not admit what you term here to-day "supply men," for the reasons given. This meeting was held on the 2d day of April, and a constitution was adopted and also a plan of licensing. The exchange took the ground that the insurance companies cannot help but reduce insurance where electric light installation were made perfectly, and you have heard Mr. Barton's paper this morning, which states that he acquiesced in that, that a perfect installation of electric light lessened the danger, and we took the ground that electric light was the least dangerous artificial illuminant in existence; but we took the ground also that the electric light plant should be perfectly well installed, and, therefore, we propose to license—and we have done so since—employés of electric light companies operating electric light, and employés of wiring companies wiring buildings. The result soon shows itself. In less than six months from the time that the organization was started the insurance companies of their own accord made a reduction in insurance rates on all buildings and manufacturing establishments where electricity was used as the only illuminant, a reduction of 10 per cent. on incandescent and 5 per cent. on arc light plant. Meanwhile a great many difficulties came up between different companies which the board of referees. as we called them at first, but whom we now call the board of directors, always amicably settled. I know of places where the electric wires were run and did considerable damage to the telephone interests in the city, and the telephone interest being there first, naturally felt very much aggrieved. We have settled such matters between the companies without their having recourse to law. The prime object always has been to look for good work. Manufacturing companies and operating companies alike had a common interest to have good work done. The manufacturer said that poor apparatus well installed would operate a great deal better than a good apparatus poorly installed, and therefore the interest was common, just the same as I believe it is here. Lately, however, some trouble arose in the city of Boston regarding fires that were said to have occurred there from electric wires, and the board of underwriters of the city of Boston were going to adopt more stringent rules. We invited them to meet with us, the tariff committee of the Boston Fire Underwriters' Union and the electric light committee of the New England Exchange and the inspectors of the Insurance Exchange, and in common with them we discussed this matter, and as a consequence this circular was issued Feb. 1.

BOSTON FIRE UNDERWRITERS' UNION.

Special Notice.

55 Kilby Street, Room 61, }
BOSTON, Feb. 1, 1889. }

To Electric Lighting and Wiring Companies:

It has been decided by the Boston Fire Underwritersi Union that on and after March 1, 1889, they will not approve "Underwriters' wire" for electric light wiring in any manner, inside of buildings. Moisture-proof and waterproof wire must be used. All loops, or drops, from poles or other outside structures, to and into buildings, must also be of a heavy moisture-proof insulation. It must first be submitted to the electrical inspector for his approval. This rules applies to all new work, also to any change made in old work. Parties who have made contracts for wiring calling for "Underwriters' wire," which contracts will not be completed before March 1, 1889, must send a written notice to the electrical inspector of the Boston Fire Underwriters' Union. If such notice is not given the work will not be approved under any circumstances. Any contract made subsequent to this notice, and not strictly complying with these rules, will not be approved.

At a meeting of the Underwriters' Committee, held Jan. 28, 1889, it was voted that on and after May 1, 1889, all electric lighting and wiring companies' men, who are in any way responsible for any of the wiring, running of dynamos, or care and management of batteries for electric lighting, must hold a license from the N. E. Electric Exchange. This rule applies to isolated plants and central stations alike, and is imperative. No exception to it will be made. OSBORNE HOWES, JR., Secretary.

I read this to you to show how harmonious our relations are now, that a year ago seemed to be antagonistic. The plan of licensing has further been approved since, I have been advised, by the Legislature of the Commonwealth of Massachusetts, who have incorporated this exchange and given it power to grant licenses. In order to promote ambition in excellence of workmanship, and to extend the knowledge among men practically engaged in installing and operating electrical plants, and thus make it an object for fire underwriters to recommend the introduction of electricity in preference to other means of producing artificial light and power, the New England Electric Exchange will issue licenses of five classes, each class representing a certain extent of qualification. First-class licenses are issued only to persons fully competent to install and operate any electric light or electric power plant. The applicant for a first class license must be able to make working plans for central stations and for isolated installations; must have a general knowledge of the construction of dynamo-electric machines and the electrical appliances neccessary for electric light and electric power installations, a general knowledge of the principles, the construction and installation of primary and storage batteries, a thorough knowledge of the insurance rules pertaining to the business, a specific knowledge of the systems operated by the applicant, and a thorough knowledge of the calculations necessary for and the rules governing electric wiring, and be able to make complete wiring plans. From this class we go down to those requiring less and less knowledge, to men who are not competent to do electric work. Fifth-class licenses are issued to persons competent only to operate electric machinery, and who are not competent to do electric wiring. The applicant for a fifth-class license must have a general knowledge of the operation of the particular electric light or electric power machinery it is desired to operate and a thorough knowledge of the insurance rules pertaining thereto. You can readily see what great difficulty we have in examining these different men all over the New England States. We arranged for examinations weekly in Boston, but it was a very difficult thing to bring the men there, especially as they were not forced to go there at first under insurance rules. We found a great many very eager to take advantage of this, and very eager to know exactly themselves how much knowledge they did possess, and rightly so. It was often questioned, "Who are your examiners, and who examined your examiners," as one man put it to me. Well, we have in New England a good many good electrical men. We had Prof. Anthony and Mr. Hill, of Boston, on practical work. We generally take three men to work together, two of whom would be good practical men and one having a good knowledge of theory. These gentlemen have to serve right along, without pay. I want to say that in order to make this a success it was neccessary for about twenty-five of us to give half a day each week to this business exclusively—to devote themselves to this matter at the loss of their own business; but they have done it; we have found men who have done it. We have now six examining boards, composed of three each, and we have five on the directing board that meets every Monday. Every safeguard was put, however, around the issuing of licenses. These examiners would examine the applicant who made application for a certain class. How few of them attained it the last official report, which dates now some months back, will show. I find that forty-three men applied for first-class license and only twenty-six obtained it; of forty-five who applied for second-class only thirty-one were successful; while forty-two men who had applied for higher class licenses received only a fourth class. But they were quite satisfied and we have a great many letters from them saying, "Why, we simply go ahead and will try again." They have a right to come again and again for examination. They have in several cases brought to the second examination a great deal more knowledge than they ever had, putting their whole heart into it now, having something to look forward to and to attain. They have done very well; the plan has worked well and the men themselves have done very well. After the examiners have gone through and made their minutes of the examination they send their report to the board of directors, who weigh that matter carefully and either send the report back, if not in accordance with rules laid down here, or accept it. Then, before issuing these licenses, each examiner has to sign the certificate that is issued; the president and secretary have to sign the certificate; and then once more we send it to the insurance inspector of that district, who comes in personal contact with these men, and who can tell us, although they may have a knowledge of the business, the men may be careless in carrying out their work. We have also a clause by which we can revoke any license that has been given to a man who proves incompetent afterwards, or careless in his work. We have found that men perfectly able to operate electric machinery are incompetent by reason of neglect and carelessness. Now, your resolution last summer asked this committee to recommend to the National Electric Light Association what means should be taken to attain the same object. I have given this matter thought only a couple of days, but I cannot see how the National Electric Light Association can establish a plan of lighting of this kind, unless they divide the United States up into sub-districts or recommend State organizations; that is, work hand in hand with the insurance people, or, if you please, independent of it, for I think in New England the electric exchange now would get along without insurance examiners, and I have predicted to some of my friends, insurance examiners who are here from New England, that the time will come when insurence companies in New England will not require an examination, they will only require this certificate of the foreman in charge of that work as a guarantee that the work has been done well. I want to say before I sit down that Mr. Barton's paper this morning, as well as the remarks I have made, would probably be best supplemented if the president would grant the New England Insurance Inspectors who are present here, but not members, the privilege of the floor.

The CHAIRMAN: We shall be glad to hear from Capt. Brophy.

Capt. BROPHY: If the New England Electric Exchange fulfills its promise half as well as I hope it will, the office of insurance inspector will be no longer necessary; but that individual will happily lay down his cares and tribulations and seek other fields for the exercise of his powers. The insurance people of New England perhaps have taken a more intelligent view of the electric light matter than almost any other body of insurance men throughout the United States. There is no antagonism between the two bodies, but the insurance men stand sadly in need of enlightenment in regard to many points of electric lighting. It is now too late for me to say that every one recognizes that the electric light is the best form of artificial illumination known at the present day; it is for you gentlemen to prove to the masses of people of this country that it is also the safest. That you can do so I am sure. I find that now the various companies—construction companies and electric light companies—heartily co-operate with the insurance inspector in attempting to prove this. When we have competent men in every station in New England ready and willing and taking a pride in doing their work as they ought to do it, the sensational newspaper of the day will have one less theme to expatiate on. (Laughter.) All that the intelligent people of this country, particularly insurance interests, require is light. We hope that throughout the country, as we have already begun it in New England, both parties will interchange views and become better acquainted with each other. Now, it is very difficult to secure a fair share of insurance on the best equipped electric light stations in the best companies. In New England we have had scarcely any loss to speak of when the amount of insured property invested in electric light stations is taken into consideration; but we are met with the fact, I suppose, that they do have severe losses outside of that territory. We have just now blocked out a schedule of rating for electric light companies, and I trust that this organization will assist us a little, by any suggestions they may have to make before that is promulgated, so that when you comply with the requirements for specification in this rating you will get what you have not been able to secure yet: a fair share of insurance, and at the lowest rates. If you choose to deviate from that, you will have to pay for it. The moral hazard that is attached to a great many other kinds of business fortunately does not exist in this. You are under contract to deliver a certain article; you must deliver it every day in the year; there is no motive whatever for the electric light company to saddle off their property on the insurance people; and when the insurance people understand this thoroughly, and many other things that we ought to know, I think there will be no friction—certainly will not be in our section of the country, and we hope to educate those in other sections up to our standard. The matter of insulation I hoped would have been settled in a little different way here from what it has been; but as the Insurance Exchange of New England is under no obligation to any one, maker of wire, or anybody else, we will take the bull by the horns ourselves, and settle it so far as we are concerned in our section. All now that is required of you gentlemen is to do what you know how to do and see that it is done—to make fires caused by electric lights or electric light wires so scarce that they will hardly ever be heard of. I wish to correct one statement made here yesterday which should not go abroad, because it is not strictly proved. It was true that a little while ago the insurance people of Boston were somewhat agitated over the frequency, as they thought, of small fires in that city, caused, or said to be caused, by electric light wires, or by electric lights. I regret to say that that feeling in the breasts of insurance men was largely engendered by electric men themselves. It will not do for you in order to run down or decry your opponents or competitors to make it appear to the average insurance man that all systems of electric lighting are unsafe. Bear in mind that when you make them believe that one system, because it is not the one you are dealing in, is unsafe, they naturally conclude that the same rule applies to all. Now, that was fomented in that way. It was stated here that every one of these fires was caused by underground wires. That is not true. The fires in New England, unfrequent as they have been, have not been confined to any one particular system of electric lighting; they are equally distributed among different kinds or among different systems; but happily they have been so few that very little or few losses have had to be paid. We have had since the introduction of electric lighting in New England four electric light stations burnt; two of them from causes entirely separated from the business carried on in them. Two might possibly have been traced to electrical causes, and each one might have been prevented by a reasonable amount of forethought. When you take into consideration the amount of money invested in New England—over $10,000,000, I think—in electric light stations, that is but a very a small amount; and if any other section of the country does as well, I should be glad to hear from it. Now, the New England Insurance Exchange takes a little credit to itself for the existence of this state of affairs there; but without the active co-operation of the men in the business, their efforts would be fruitless. I wish to say here that we have met and received that co-operation and are doing it to-day. All we want now is for the electric exchange to give us the suitable men and furnish them with new qualifications, and perhaps in a few years hence I shall not be called an inspector for the New England Insurance Exchange. (Applause.)

Mr. KILLECUTT, Boston: I do not think that I can add much to what Mr. Brophy has already said, but I can voice the sentiment which he has already expressed, and I think, as most likely all of you do, that better insulation and construction will take away a great deal of fear which is running in the minds of a great many insurance people and a great deal of the whole community at large. I think that by means of the direction in which we are trying to head the matter in New England we will steer clear of any calamity which might befall the community, and as Mr. Brophy says, the statement which was made here yesterday was evidently a mistake, as regards the fires which happened about New England. The statement which was made was directed at Boston, and as I am the inspector for Boston alone, of course I got the largest share of it. We have only had in Boston, since I have been there, five years, about fifty fires, and the whole loss of these fifty fires is only in all something about $34,000, and these ranged all the way from perhaps $2.50 up. There were a great many fires, as Mr. Brophy says, that the intelligent newspaper gave the public a large headline to, which frightened nearly all the public to death, and kept the people in a state of fright, which some of companies in Boston would like to make capital out of, taking advantage of one another's misfortune. They stirred up the insurance people, who are not supposed to know a great deal about electric lighting. They are better insurance brokers than electricians, and, of course, there was a great deal of disturbance, but I think the matter has quieted down now, and I trust that a few years hence, as Mr. Brophy says, I shall probably be looking for another position. In the loss on all fires which I have mentioned, $24,000 was for the Edison central station which was burned there, caused by the feeders being short-circuited—some of this valuable underground. But we do not want the public or the convention to think that Mr. Brophy or I either have any objection to underground work, because when a good underground system comes along we shall be only too glad to have it put in. (Applause.)

On motion of Mr. Morrison the report of the committee was accepted and the committee continued.

Mr. MORRISON: I move that the thanks of this conven-

tion be given to Captain Brophy and Mr. Killecutt for the very intelligent manner in which they have placed the case of the electric lighting people from the official standpoint of the insurance men.

Mr. ALEXANDER seconded the motion, which was unanimously adopted.

The CHAIRMAN: The next in order will be the paper of Mr. C. H. Rudd.

Mr. Rudd then read the following paper on "Disruptive Discharges in Lead Cables":

DISRUPTIVE DISCHARGES IN LEAD CABLES.

In coming before the Association at this time with the subject named, my principal object is to consider the experiments of Mr. E. G. Acheson. An account of these experiments* appeared in the New York *Electrical Review*, July 7, 1888, and was enlarged upon by Mr. Acheson at your last meeting. The results of the investigations suggested two conclusions: First, that the static capacity of a cable is a transforming agency by which a passing current might develop a static charge of greater electromotive force than the electromotive force which produces said current; second, that a static charge will not pass an arc. These conclusions are radical and cannot fail to attract attention. If they are sound, they have a most important bearing upon cable service. By virtue of the first conclusion, we would be obliged to largely increase the value of cable insulation, or else put on high pressure protectors of a nature to carry a constant stream of sparks. And we would be obliged to ask: Why have we not had a much greater number of burn-outs than we have? By virtue of the second conclusion, the high pressure protectors, if used, would have to go into every section of cable cut off from other sections by lamps. I do not believe these conclusions to be sound, and expect to show that they are not. I question the first because it conflicts with the well known law that the electromotive force of a static charge cannot exceed the electromotive force of the charging source. This law is as well sustained in daily practice as in Ohm's law. If the results of an experiment point to the overthrow of a long established principle, the experiment itself will bear inspection.

Let us look at the experiment from which the first named conclusion was drawn. Fig. 1 is an exact copy of Mr. Acheson's diagram. *H* is an alternating dynamo, *T* is a transformer in which a portion of the wire is used for both primary and secondary; *R* is a switch to aid in obtaining different degrees of pressure; *E* is a switch with which to break the secondary circuit; *F* is a switch with which to break the primary circuit; *C* and *D* are posts supporting points *A* and *B*. The distance between points *A* and *B* is adjusted by means of pointer *P* and scale *S*; *G* is a piece of fusible wire for safety; *K* is a condenser. Now let us suppose condenser *K* to be disconnected for a moment. It was in that form that the first step was taken. We are told that by rupturing the circuit at *E*, the vital element necessary to make it demonstrative, every deduction made from said experiment must fall to the ground. The subject under investigation by Mr. Acheson is treated of by Gordon under the head of secondary condensers. A secondary condenser (see Fig. 3) is said to add to the burning power of a spark. If Mr. Acheson had made a proper series of experiments in the laboratory, and had then desired to carry his work over into practical life, he would have first obtained a cable carrying heavy current, the cable having in it a spot so weak that the direct pressure was able to break through. In such a case he would have sparking points around which he might connect his secondary condenser, and observe its effect upon the burning power of the spark. He would, however, require some sort of electrical microscope with which to make his observations. That any ordinary method of noting the effect of a condenser upon the spark which I have described would be of no value, is manifest, when we consider that a condenser of one microfarad charged to a voltage of twenty-five hundred would hold .0025 coulombs. A current of one ampère carries one coulomb per second. As it is coulombs which determine the destructive power of a spark, it is plain that when direct pressure begins to break through a weak spot in the cable, the addition to its destroying power, which it received from the condenser capacity of the cable, is extremely insignificant. To sum up my position concerning Mr. Acheson's first conclusion, I will say that the static charge in an ordinary cable is a neligible quantity when compared with the regular current flowing, and the electromotive force of said charge cannot be greater than the electromotive force of the current from which it was derived. Therefore, in considering the character and thickness of insulation, we have nothing to take account of but the primary pressure which bears upon the insulation. Mr. Acheson's second conclusion, viz., that a static charge will not pass an arc, virtually declares an arc circuit to exist as a number of sections in a solenoid insulated from each other, and in that connection the statement is made that each separate section comes under separate strain every time that the circuit is shut down. I think that I have already satisfied you that we may hold our old ideas concerning the electromotive force of a static charge; therefore we need not fear that an imprisoned charge would do any more harm than the current did from which it came. If we charge an ordinary condenser from a battery, and the condenser does not break down, we do not apprehend that the condenser will break down when we disconnect the battery. There is in the minds of some people an idea that static electricity, when it begins to move, produces a current possessing different properties from current formed by other electricity under the same conditions. This idea is unsupported, and need not be entertained seriously.

But let us see how Mr. Acheson proves that a static charge will not pass an arc. See Fig. 4. *T* is a transformer yielding 2,067 volts; *S* is a break switch; *W* is a condenser; *A*, *B*, sparking points, *C*, *B*, adjustable points so arranged as to be readily placed in contact; *L* a circuit of twenty incandescent lamps in series measuring perhaps four thousand ohms all told. Mr. Acheson says that when contact was made between *C* and *D* no amount of rupturing the circuit at *S* produced a heavy spark at *A B*. From this the conclusion is drawn that the arc is an effectual barrier to the passage of static charge. Let us see. If we have an arc burning at *C D* it would expire simultaneously with the arc which would form at *S* when *S* is opened. Therefore the retardation spoken of by Mr. Acheson was due to the break at *C*, *D*, *D*, and not to the arc at all, the arc having expired before the observation under retardation was made. To sum up my position as regards the second conclusion, it is evident that the arc affords free passage to ordinary currents, and we have nothing to indicate as yet that the arc makes distinction between the static charge in motion and other electricity in motion. It is also evident that the insulation of a cable does not undergo strain at shutting down due to the static charge. Mr. Smith referred at the last meeting to some sparks observed when an arc circuit was shut down. These sparks may be readily attributed to magnetic discharge from the lamps.

I will now speak of an experiment in which I assisted ast summer. The experiment is one which Mr. Sunny described before this Association in August, 1888. 1,000 feet of lead-covered cable was laid out upon an ordinary dry floor. This cable was connected as a loop into a working circuit. When first connected up, condenser *C* could be strongly charged by placing it in circuit between *B* and *S*, Fig. 5. At first sight it seemed that Mr. Acheson's position was confirmed. An attempt to repeat this experiment on the following day resulted in failure. Another attempt on the third day succeeded. I arrived at this stage of the proceedings. Upon examination, I found that different working circuits had been used each day. The leading idea

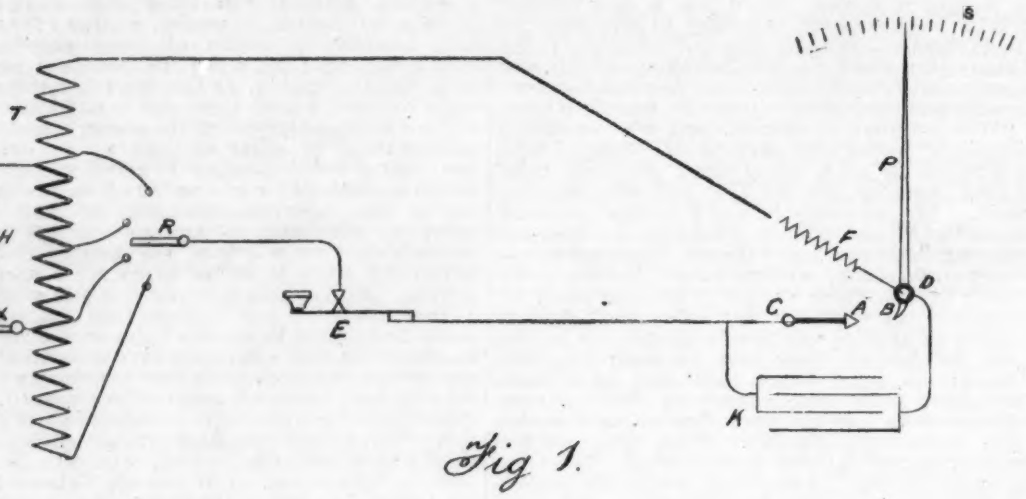


Fig 1.

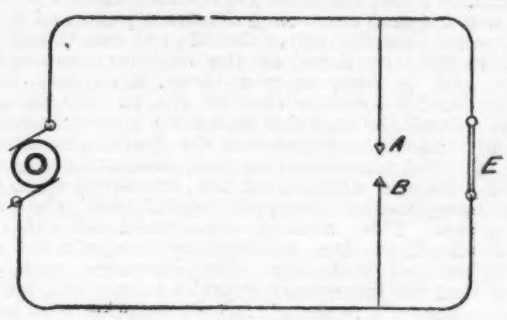


Fig 2.

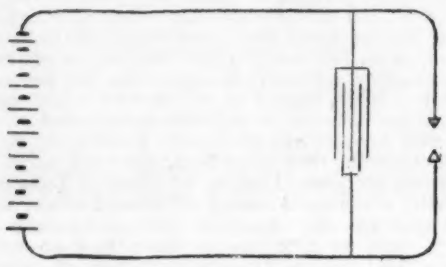


Fig 3.

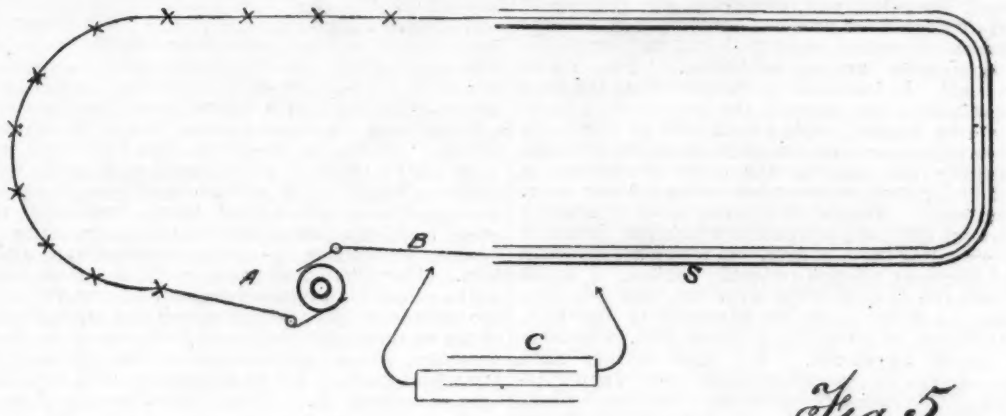


Fig 5.

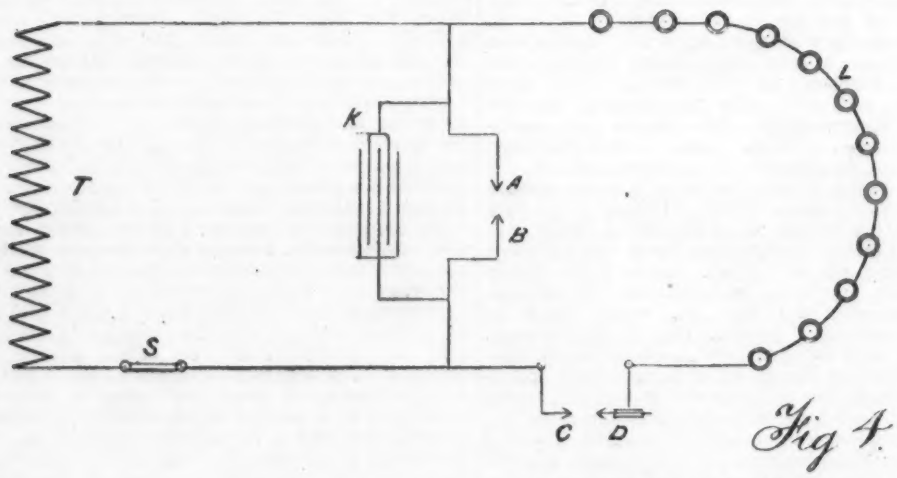


Fig 4.

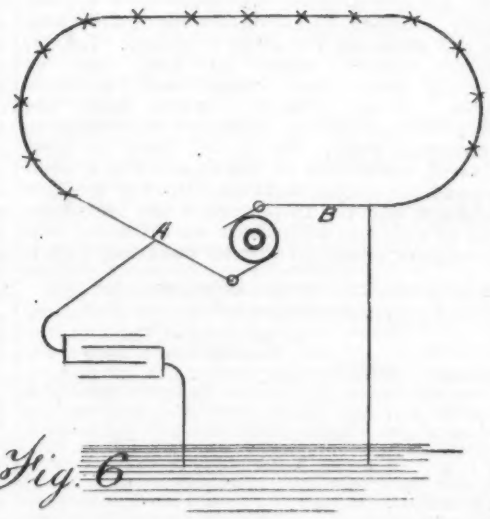


Fig. 6

DISRUPTIVE DISCHARGES IN LEAD CABLES.

* See THE ELECTRICAL WORLD, July 7, 1888.

in the experiment was that if a current would create a static charge of a nature unlike said current, the results should be obtainable from any working circuit. When I learned the conditions of the various experiments, I affirmed my belief that the results obtained were of the most commonplace nature, and requested that the steps in the experiment be repeated. This was done. We found that when we put the extra cable into a circuit entirely under cover scarcely a sign of charge could be seen in condenser *C*, but upon plugging into a circuit exposed to the weather, a definite charge was obtained. We then returned to the covered circuit. Results were same as before, viz., no charge. We then put a ground at *A*. This gave us a strong charge. We then began to observe the polarity of charge, and found that we could reverse the polarity by putting the loop in at *A*, and the ground at *B*. This change removed all ideas that the results obtained were out of the ordinary, and let us square down upon the common principles of every day life. The shield *S* was a ground of some value, so we concluded that we had been trying to see if we could get a charge out of a working dynamo by connecting a condenser between *A* and the ground with a ground at *B;* and again if we could change the polarity of the charge by putting the condenser between *B* and ground with ground at *A*, Fig 6. A rather simple experiment when stripped of its useless features.

In conclusion, I will say that if disruptive discharges occur in properly insulated cables, we must look for the cause in those sources of high pressure which exist in nature. I do not believe that burn-outs can be ascribed to any one cause, but that each individual case has its own individual cause. In practice we must provide insulation strong enough to meet the daily strain and suitable devices to prevent the accumulation of charge from outside sources of greater pressure than the insulation will bear. As yet we have no proof that high pressure protectors are required anywhere outside of the station from which the wires start. Mr. Acheson says that the greater number of grounds or burn-outs occuring on arc light circuits are at the terminals of the lead or at the joints, and says that such a state of things would be naturally caused by the greater density of the static charge at these points. This statement strikes me as a singular carrying over of ideas obtained in laboratory work with purely static electricity and arbitrarily applying them to entirely different conditions. The natural static charge in a cable, due to the distribution of the working electromotive force of the current in the cable, must necessarily be governed in its distribution by the force from which it originated. The shape of the conductor cannot act in the matter of this kind of static distribution, as the shape of an insulated conductor would act upon a purely static charge. This remark of mine about distribution may not be treated of by any of the men who write books, but I confidently appeal to my hearers for support. As regards burn-outs occurring at terminals and joints, we know that great care is required to make these points equal to the rest of the cable in a matter of insulation. I do not see how it can be known that burn-outs at such places are not due to accident in construction or neglect on the part of the workmen.

Prof. BARRETT: I would like to ask Mr. Rudd a question before he leaves the stand. I came in near the end of his illustration, and one remark that he made there is not entirely clear to me. He states that the disruption must be determined by the size or thickness of the insulation.

Mr. RUDD: I don't quite understand you.

Prof. BARRETT: I understood you to say that the disruptions were determined by the thickness of the insulation.

Mr. RUDD: I made the remark that if the insulation was too thin to bear the direct pressure that the static capacity would have no effect upon it.

Prof. BARRETT: What I meant to ask you is hard to determine; about the thickness of the insulation to fit any proportionate amount of pressure.

Mr. RUDD: I did not intend to bear upon that point. I have endeavored in this paper to merely make as plain as I could the general principles involved in the discharge of the current through a cable having some capacity. I did not intend to bring up the subject as to what thickness of insulation would be required to meet any given pressure. That has already been discussed by other gentlemen at other times. I did not intend to bring up any such point.

Mr. LOCKWOOD: I would like to ask about the professor regarding one point on which he has spoken, that if there be a slight spark at the breaking of the circuit, as spoken of by Mr. Smith, which is ascribed to the discharge of the electro-magnets in the lamps, whether all the magnetism, not only the electro-magnetism in the lamps, but for instance in the field magnets and armature—whether all that magnetism used in breaking the circuit, no matter how sharp it is, but if it is all broken away—whether the electromotive force breaking the circuit is raised above its normal potential or not.

Mr. RUDD: At the time of pulling the plug the current is broken; the field magnetism would be cut off by the other current.

Mr. LOCKWOOD: Let me give you an example. We will suppose on one leg of the regular circuits between the dynamo and the first few lamps is some lead covered underground cable; on the other side is the ground. Suppose, then, beyond the ground, that, for instance, in the middle of the circuit, the circuit is open; then the field circuit of the dynamo would be connected with the ground on one side, and the conductor, this lead covered cable, on the other side. Would the potential of that discharge have any greater capability of making a short circuit on account of the discharged current?

Mr. RUDD: Now I understand you. The circuit broken in the middle; in that case I say it would. A circuit broken in the middle allows the hardest strain that you can put on a circuit.

Mr. LOCKWOOD: Then the potential does rise in that case by discharging the current?

Mr. RUDD: I think it does. But you ask me in disconnecting the plugs from the switch-board what becomes of the field magnetism. Now, if you should take an axe and chop into the light and cut the circuit in the middle, I would not undertake to be responsible for the result. I would not look for anything but a direct p essure to make you trouble in that case.

Mr. ACHESON: I have been exceedingly pleased in listening to this paper. The gentleman has given me much pleasure by the paper he has prepared, owing greatly to the fact that my original experimental work was done with the object of eliciting replies and drawing others into this work—a work that must be done by somebody, and a work that I have but few facilities for doing. It was only partly done, and in fact only begun, at the time of the convention in New York, and I there presented the little portion that I had prepared, and since then I have been continuing the subject in a limited way, as a great deal of work has occupied my attention. But I have here a few notes of some work that I have done during the last week. There were two questions, I believe, which Mr. Rudd said that the matter turned on—either I was demonstrating or had discovered a new principle, or else it was all wrong. I do not think I discovered a new principle and I do not think it is all wrong; but he seems to think that I have assumed an increase of energy owing to the existence of the cable—an energy that is formed or produced owing to the existence of the cable. That is not exactly the case. We have, though, owing to the fact that the cable is there, an energy on hand that is not contained in the dynamic current and it is *that* which produces our discharge; and following that up in a very limited way, I find, for instance, from the experiments of Prof. Blaserna, we are to conclude that the time occupied by the induced current in a secondary wire, upon opening the primary, is about .00025 of a second. This time is sufficient, and more than sufficient, for the formation of a spark. The time necessary for the spark is about .000008 of a second.

The amount of energy contained in or represented by the dynamic current in 200 feet of No. 6 B. & S. W. G. conductor, when conveying a current of 10 ampères, will for each second of time be 8.2 joules, and the amount of energy that may be withdrawn from such a conductor under such conditions, in the .00025 of a second—or that occupied by an induced current—will be .00205 joule.

Now, if this same conductor be in a cable and have a capacity of .01 M. F. for the 200 feet, and it be subjected to 2,000 volts potential, the energy due to the static capacity, and which may be withdrawn in an interval of time equal to the .00025 of a second, will be .04 joule.

Thus the work that may be done by the current due to the capacity is about twenty times the value of that which could be performed by the dynamic current.

Mr. Rudd assumes that I have supposed an increase of energy or a building up. It is a building up, or rather it is a condensation, you may term it, owing to the capacity, and it enables us to do about twenty times as much work as could be done by the dynamic current. Some experiments I made were in relation to the time necessary for a discharge from the more remote parts of the cable. I wanted to learn how the distance from the terminal would effect this discharge, and although I have lost my notes, I have roughly jotted down some of the data from memory. My experiments were made with wire No. 18 Brown & Sharpe. There were various lengths of wire through which I could discharge a current that was held in a jar having a capacity of twenty-five ten-thousandths of a microfarad, and charged up to such potential that it would discharge through two hundred and eighty-six thousandths of an inch. With that amount of energy discharged through the wire, I produced an induced current in a parallel wire and used that as a means of determining the time or rather the rapidity of change in the inducing current affecting directly the electromotive force in the parallel wire. With a wire ten feet long—my parallel wire was about five feet in length—I could get a discharge between the terminals of the terminal wire of one hundred and fifty thousandths of an inch. As the primary wire was lengthened to twenty-five feet, the discharge became about seventy-five thousandths of an inch—I have forgotten exactly—and it fell to about forty thousandths at one hundred feet. From there on the curve flattened out, and at two hundred feet it had not dropped probably below thirty-five thousandths. Now, from this I rather argue that the first 100 to 150 feet is the portion of the cable that is going to effect this discharge. The other portions beyond that cannot deliver their energy with sufficient rapidity. It shows the necessity of the energy being delivered instantly, in a time far beyond any measurement of ours—in the eight millionths of a second. Now, if Mr. Rudd will kindly permit me to use his diagram, I would like to say something further. This diagram, Fig. 1, shows the apparatus first used to determine the electromotive forces of these various sections of the transformer, and also the required electromotive force with any given condenser or capacity for the discharge. Now, as I stated, my experiments at that day were hardly begun. I had not yet learned the true cause of this, and the fact of the necessity of explaining it does not detract, I should think, from the existence of the results. They still exist, regardless of the fact that any necessary explanation which I, at that time, did not have, but which afterward has been partly shown. The lengths of the wires connecting the condenser was certainly a few inches. I have forgotten the lengths. In fact, I did not at that time appreciate the necessity of measuring them, but they were probably perhaps four or five feet. Now I have just shown that five feet of wire lying parallel to a primary wire receive an induced current sufficient to discharge through $\frac{15}{100}$ of an inch, and we know that a current induced in a parallel wire is not as great as that induced in a primary, in case the secondary is absent. The current in the primary is the greater of the two. When we open the key *E*, we have a charge in the condenser, and on opening the electromotive force drops and the condenser will tend to discharge. It will induce a current in the connecting wires, but owing to the opening at *E*. the self induced current will discharge at points *A B*. That is a possible explanation, and it is not one that I absolutely assert is true. It is only in a condition of study with me. I am not through with it and I am glad to have the assistance of any one who is willing to join in the work.

But Mr. Rudd did not draw attention to the existence of the condenser in this diagram. He referred to the fact that opening the switch *E* lengthens the distance between *A* and *B*. How he supposed that I in any manner attributed the opening of that and the necessary increase of this to the production of a spark, I cannot understand.

Mr. RUDD: Pardon me. Mr. Acheson, didn't you do your first work without the condenser?

Mr. ACHESON: Yes, I find that I did, but I believe that I attributed that to the capacity of the circuit. I actually gave the capacity of the circuit as the four ten-thousandths part of a microfarad, and that this part, without the other condenser, was due to the capacity of the circuit. In no case did I consider it without the capacity; for, though I sometimes tried with the expectation of not getting it, I still found it in the circuit.

Mr. RUDD: I would say right here that I took the ground that if capacity was at all necessary to make the spark plain, the capacity then was a primary condition and not merely an auxiliary condition, and I understood that you examined the auxiliary effect of condensers, or the effect of the condenser upon disruptive discharge. Where a tendency to discharge already exists you desired to find out how much that was increased by the presence of the condenser.

Mr. ACHESON: Of the condenser and of the energy it delivers at the disposal of the work to be done. In the paper read in New York I believe I stated that there was no time for the generation of a current in the dynamo. You had to have it on hand. As I have shown here the actual energy transmitted over your wires, in this small interval of time, is but a fraction of that on hand, owing to the existence of your cable and its capacity; it is a thing you must have there to do the work with. The current passing over the wire is not sufficient.

But referring to this diagram here, Fig. 4, Mr. Rudd simply stated the case very clearly, as I explained, I believe, from the fact that when there is a spark between *C* and *D*, we get a spark between *A* and *B*. If it was understood that I stated that it was owing to the actual existence of the arc, which I may have done without intentionally doing so, I wanted to have it understood that it was due to the fact of the arcs having existed, or existing, as the case might be. It was either due to the fact of their existing and preventing the discharge passing through the arc, or to the fact that they ceased to exist and there wasn't time for the circuit to close, leaving an open space prohibiting the discharge from passing, and consequently it passed at *A B*.

Now, I would like to state here that while I was in the early stages of these experiments, I thought that I had already at that time obtained results of value to those who were interested in underground work, and that they would be benefited by knowing of these results and profiting by them. An invitation was sent to a gentleman interested in underground matters very extensively, to come and see these experiments in order that be personally might profit by them. That gentleman returned to his home and introduced the subject to various others, and they entered the experimental field with a decided desire, as has since developed, to obtain results contrary to those which I had obtained, and which had been offered to him gratuitously for his special benefit. This work is some of the results of it, and this is one of the experiments made at that time (Fig. 5.) Here we have a piece of cable placed in our circuit. The experimenters have taken a condenser and connected one of the terminals to the line wire. The statement was not made as to the distance between the end of this cable and the point on the line where this terminal was connected. But having done this, they obtained a spark on making a contact with the terminal and the cable, which should not surprise them, provided the distance between these points was of any value. After doing this they connected the ends and got a discharge that certainly would not have produced the beliefs or theories that I had formed. There will, under certain conditions, be a different value obtained, as was shown by the fact that when the cable was dry they could not get a charge of much value. When it got wet they did get a charge of more value. When it got wet this cable, instead of remaining a conductor simply parallel to the line wire, became more or less grounded throughout its entire length, and in place of getting your potential at any point as *S*, which is produced by line wire, that point would be removed a certain distance. But, however that might be, your charge could be of any value governed by the distance you would carry your point back toward the machine.

Mr. RUDD: It was two or three inches.

Mr. ACHESON: Then it would be dependent on that, and your grounding of the cable would throw that point back still further.

Mr. RUDD: If you will pardon me, I think I carried it to the other side of the dynamo.

Mr. ACHESON: Then you would get the entire charge of your machine in it.

Mr. RUDD: We got a very decided charge, considering the resistance of the field.

Mr. ACHESON: That diagram, Fig. 6 is Fig. 5, changed in its connections, and neither of them has any relation whatever to determining the value of a discharge, owing to the current condensed in the cable. In your first two hundred feet of cable, the interval of time necessary for your current to be delivered and discharged to your terminal is greater than that occupied by your spark. But then, in your first two hundred feet your energy is of greater value than that obtained in the dynamic current in a similar range of wire.

Dr. MOSES: Can Mr. Acheson explain to the convention some of the arrangements by which he determines the relative value of the static discharge in the conductor? I simply ask in order that we may be approximately able to assume that your observations are correct. You spoke of a rather sharp fall in a distance of 50 or 60 feet. Some little explanation perhaps of the manner in which it was obtained would give a clearer idea of the matter.

Mr. ACHESON: The real facts are that these experiments are going to be of a quite extensive character, and I am husbanding them up for future use. (Applause.)

The PRESIDENT: I desire to take the opportunity now of formally introducing to you our new president, Mr. E. R. Weeks, of Kansas City. (Applause.)

Mr. WEEKS: I have too deep a sense of the high honor that you have conferred upon me to fail to doubt the wisdom of your choice. Although my home is very near the geographical centre, it is some thousand miles west of the electrical centre of the United States. In view of this fact, and knowing that you have many members much better qualified to fill the office of president of this association, I take your action in large part as a recognition of the great West, as a recognition of the sleepless enterprise and indomitable pluck that is rapidly converting the Great American desert into green pastures, blooming orchards and fields of golden grain, and which have transformed a vast swamp into one of the world's greatest and most beautiful cities. This association now enters upon its fifth year, and while much has been accomplished under the able leaderships of Mr. Duncan and Mr. Morrison, infinitely more remains to be done. The electrical industries lead the van of human progress. In the highest sense of the word the electrical engineer of to-day is the resultant of all engineering experience, and to the engineers of the world more than to all other professions the civilization of the present age is due. Let us remember our high calling, and with one accord strive to advance the National Electric Light Association to a still higher place among the world's industrial and scientific societies. Gentlemen, in accepting the trust which you have placed in my hands I ask you to give me your counsel, your sympathy and your most hearty support. (Applause.)

Mr. DE CAMP: I would like to offer a resolution which I will ask the secretary to read.

The secretary read the resolution, as follows:

WHEREAS, In no State, so far as can be ascertained, are the laws properly drawn to enable municipalities to contract with incorporated companies to perform services for cities and their citizens upon a sound economical basis; be it

"*Resolved*, That a committee on State and municipal legislation be appointed, consisting of one member from each State, to operate together, to secure such legislation in each State as may be required to enable municipalities to contract with incorporated companies to perform services for cities and their citizens, on the sound economical basis of securing to such companies an undivided demand, an unrestricted privilege and permanent investment."

Mr. DE CAMP: Mr. Chairman, I want to say that that is a resolution that was framed by A. R. Foote, of Cincinnati, and he gave it to me to read, saying that he was going to offer it. I advised him to offer it. He wanted me to read it, but I saw the opportunity of offering it and I did so.

The resolution was adopted.

Mr. MASON: This calls for the appointment of a committee of one from each State. I move that that be referred to the Executive Committee. The motion was carried.

The PRESIDENT: We will now hear from Mr. S. S. Leonard upon petroleum as a fuel.

Mr. S. S. Leonard then read the following paper on:

FUEL OIL.

In presenting this second paper on fuel oil, I do so with some hesitancy, not that I have less faith in its use, but because I have not the data that I would like to have in bringing the subject before this association again.

During the past few months I have endeavored to obtain what information I could upon this subject from those who have been using oil, and especially from any electric light companies. The general experience does not seem to be very favorable and I have been advised to have nothing to do with it; that the saving by its use over other fuels, if any, was more than counterbalanced by its injurious effect upon both boilers and furnaces, and that the fire risk was greatly increased, and it would be found very difficult to place insurance upon our plant. One gentleman wrote me they had just had a serious fire in their station which could be clearly traced to the use of oil, and then kindly offered to sell me their outfit of burners, pumps, etc., very cheap, should I desire to find out for myself, what they already knew, that oil was a failure. Others found that the use of oil was injuring their boilers, by burning out the flues, they being compelled to put in new ones after a few months' use. Some reported that it was almost impossible to keep their furnaces in repair, as the intense heat seemed to melt the fire-brick, necessitating the rebuilding in part of the furnace after a short use. This was somewhat expensive and amounted to more than was saved by the use of oil, so the oil was abandoned. As I read over these various experiences it carried me back to the time when we were going through the same trouble. Although we never injured our boilers, we did burn up a good many fire-brick, and were obliged to rebuild our furnaces several times. Previous to our experimenting with oil I had occasion to visit the east, and saw for the first time natural gas in use. I was strongly impressed with its many advantages, and when fuel oil was first mentioned to me, I thought I saw in it a substitute for natural gas. We were assured it was not necessary to alter our furnaces any, only cover the grate bars with fire-brick, so the heat would not injure them, put in the burner, turn on the oil, light it, and let her go. It seemed so simple and could be done so easily and with so little expense that I was delighted; but, alas! my expectations were not to be so easily realized. It was very evident fuel oil was not a success under the conditions with which we were using it. The oil was not all burned and ran down into the ash pits, where, after a while, it was set on fire and consumed. Everything was dirty and the odor was far from agreeable. Notwithstanding all this, we still had some faith, and kept at it, and are now convinced that to make a success of burning oil for steam purposes, it is as essential to have the proper settings or furnaces as it is to have a boiler to make steam.

We have been using oil for about eighteen months and for the last six months exclusively under our seven boilers; these boilers are 14 feet by 60 inches, with 44 four inch flues. During the first part of the night, these boilers are all in use furnishing steam to four Reynolds-Corliss condensing engines, from which we are using about 1,100 h. p. The steam pressure is easily maintained at any desired point, usually with us at 100 pounds. Our arrangement for the handling and storage of this oil I described in my former paper and I only wish to add, that so far, it has worked admirably.

In speaking of the economy from the labor side, I made the statement that one man could attend to from 7 to 10 150 h. p. boilers. This I am now positive of, and we have but one fireman during the night and one during the day, while when using coal we had three men at night and three or four during the day. It kept two men busy half a day wheeling out the ashes, and the other half was occupied in getting in the coal, and it was as much as one man could do to keep the flues clean. Now there are no ashes to cart out and no coal to cart in. Our flues are cleaned out once a week, and from the whole seven boilers there is not as much dirt as from one boiler with one night's run of coal. I am frequently asked if the burning of oil does not injure the boilers. A short time since, the inspector of the Hartford Steam Boiler Insurance Company made a very thorough inspection of our boilers. This same inspector had examined them a number of times when we were using coal, and was familiar with their condition previous to the introduction of oil. In reply to my question: "Did you discover anything wrong?" he replied that he thought they were in better condition than when we were using coal. Our engineer had also examined them very carefully, and up to the present time has been unable to discover any evil effects from its use, so that from the length of time we have been using oil, and as no injury is apparent, I feel warranted in saying that the proper use of fuel oil will not injure a boiler. Improperly used, and by this I mean where the flame is allowed to strike the shell in any one spot continuously, it will soon damage a boiler, and the harder it strikes, the sooner the damage; but this is true of any fire whether it be coal, wood or gas, for if the fire be blown against the shell as an oil fire is blown, it is only a question of time, and that not long, when the effect will be very apparent. By the proper adjustment of the burner, this trouble can all be obviated and the flame carried beneath the boiler and not up against it. I have already mentioned the expense of keeping in repair the settings or furnace as experienced, by some who have used oil; this should not be, and is all wrong. We have furnaces that have been in use over a year and they are in as good condition as when first built, and as far as I can see will last for a long time yet. Oil is very much easier on them than coal, is what our experience teaches. In reference to the burner, I would say that its requirements are few, but they are absolutely necessary to complete the success of using oil. It should be so made that it can be easily taken apart for cleaning when necessary; the oil should be all consumed that passes through it, whether the fire be a slow one or the burner pushed to its utmost capacity; it should not smoke, but produce a clear bright fire. When our seven boilers are going full blast not a particle of smoke can be seen issuing from the stack. The fire should be as near the front of the boiler as possible and not half way back, as I have seen it with some boilers, for with the latter you are losing a large part of the capacity of your boiler, while the former heats the water the full length of the boiler at the same cost. Do you find it cheaper than coal, is a question very familiar to me. Yes, we do find it cheaper than coal in Minneapolis, but whether it would be cheaper than coal any where, I have my doubts, as it would depend altogether upon the cost and quality of the coal used. The best quality of Illinois lump coal costs us from $3.25 to $3.50 per ton while eastern coals are worth from $4.50 to $5.50 per ton. I refer to bituminous coals. The oil costs at present 2¼ cents a gallon, delivered in Minneapolis. In comparing tests made by us with oil and coal, we find that 2¼ barrels or 104 gallons costing 2¼ cents per gallon, $2.60, will evaporate as much water as one ton of coal that costs us $3.15, being a saving of about 21 per cent. in favor of the oil. With one pound of coal we evaporated 5.38 pounds of water; one ton of coal would therefore evaporate 10,760 pounds of water. With oil, 14.8 pounds of water was evaporated per pound of oil. Oil weighs about 7 pounds to the gallon; one gallon of oil would therefore evaporate 103.6 pounds of water. With oil at 2¼ cents per gallon, it would take 126 gallons to cost the same as one ton of coal, viz: $3.15. One hundred and twenty-six gallons of oil would evaporate 13,053 pounds of water, while one ton of coal evaporates 10,760 pounds of water, being a difference of 2,293 pounds in favor of the oil, or a saving of 21 per cent. When I consented to write this paper, I fully expected to have tests made as to what we were actually doing now by indicating our engines, weighing the water and oil, etc., but circumstances have been such as to make that impossible. I have, however, calculated from the number of lamps burning, and motors running, the amount of power we were using at present, and by doing the same thing when using coal, I find that the percentage of increase in power used is considerably larger than the increase in cost of fuel, being about 15 per cent. Although I am fully aware that this way of figuring is not absolutely correct, still my figures thus obtained are so near the others mentioned that I feel they are not far out of the way and that we are actually saving in fuel alone at least 15 per cent. if not 20.

My attention has been called several times to the fact that the amount of water evaporated by us, viz., 5.38 pounds per pound of coal was very low; that is true, but the quality of the coal used was very low as well. I have made a few figures showing what would be required of coal at various prices to equal the cost of oil. With oil at 2¼ cents per gallon, a ton of coal costing $3.50 must evaporate 7.25 pounds of water per pound of coal to equal cost of oil, or coal costing $4 per ton must evaporate 8.28 pounds of water, and a coal costing $5 would have to evaporate 10.36 pounds of water to cost more than oil. Our experience has demonstrated that it takes a very good coal to evaporate 10 pounds of water per pound of coal and that quality would be exceedingly cheap at $5 per ton with us.

Those of us who are interested in electric light plants know only too well how they are considered by insurance companies. I was once in the insurance business myself, and among the classifications of risks was one that was termed the moral risk; on this the rate was very high. And yet I can hardly believe that the underwriters look upon electric light plants as moral risks, not even though they use crude petroleum for fuel; still the rate is very high. We have had some difficulty in placing insurance on our plant, notwithstanding the fact that all of the insurance men who have inspected our system are agreed that they cannot see wherein the danger lies or that the risk is any greater than it was with coal. When we first introduced fuel oil, our insurance rate was raised from 1¾ to 2¾ per cent. At that time our arrangements for handling the oil were about as crude as the oil itself, and although we thought the rate exorbitant we submitted, trusting that should we finally adopt the oil for fuel, the insurance companies would restore the rate to about the old figures; but no, it made no difference whether the arrangement was good or bad, the rate remained the same. Under certain conditions you are permitted to use oil without extra charge, but these conditions are almost prohibitory, especially if real estate is at all valuable in the vicinity of the plant, as, for instance, if you keep the oil in tanks 200 feet from your building above ground. For 100 feet, if under ground, it can be used without extra cost, I believe. Some companies allow the tanks to be as near as 50 feet, if underground. I do not believe the danger lies entirely in the situation of the storage tanks; in fact, I think that has very little to do with it. There is no doubt in my mind but that the tanks should be underground and so arranged that they can be got at, and should a fire occur in the building and it becomes necessary to shut off the supply of oil, it could be done at the tanks as well as in the building. It is the opinion of many insurance men that our building could burn to the ground and the oil in our tanks not be affected in the least, and our tanks are about 25 feet from the building underground. I do not mean to say that no restrictions should be put upon the use of fuel oil; there should be by all means—it will burn and it makes a bad fire—but I do say that where properly put in there is as little danger as from any other fuel used and by properly I not only mean the storage tanks but the entire outfit, burners, piping, furnaces and all. What insurance companies ever thought of restricting the location of your coal shed to 200 feet or even 50 feet from your buildings and yet we had more trouble from coal than we have ever had from oil? Several times our coal sheds caught fire from spontaneous combustion, still a little thing like that did not trouble the insurance companies any and there was nothing said about raising rates. I am of the opinion that the insurance companies will soon discover that they are making a great mistake in condemning the use of oil on general principles.

Mr. M. J. Francisco then read the following paper:

OIL AS FUEL.

I have been requested by your secretary to bring before this association for discussion the subject of liquid fuel, with facts pro and con regarding the benefits to be derived from its use. Do not let name mislead you. I do not refer to the liquid fuel that Dante saw, "which fed the fires in that abyss that Lucifer with Judas did engulf," but to the liquid fuel of the nineteenth century—petroleum oil.

At the present time we have no knowledge of any means of securing light without heat, and it only remains for us to employ the most economical fuel to produce the heat without useless waste. It has been asserted that the question of dividends in electric lighting lies between the shovel and the dynamo, and the fraternity have been taxed to their utmost to provide a plan for dispensing with the shovel entirely and thus securing at least a part of the much coveted dividend. Petroleum, it is claimed, will furnish the substitute. Query, will it? One pound of coal contains 12,000 heat units, while one pound of petroleum furnishes 20,000. Another factor of vital importance is the power to vaporize water. Engineers of experience who are familiar with the practical workings of coal know that under the most favorable conditions, not more than ten pounds of water can be vaporized per pound of coal, while petroleum shows a vaporization of 18 pounds of water for every pound of oil consumed, estimating in both experiments the feed water at 212 degrees Fahrenheit.

The heat in coal, transferable to water, is about 70 per cent., while the heat in petroleum, transferable to water, is about 80 per cent. Therefore, with coal, 70 per cent. of 12,000 units gives 8,400, and for petroleum, 80 per cent. of 20,000 is 16,000, a gain of 7,600 heat units in each pound. This is on the basis of pure coal; but when we consider the waste (amounting in some cases to 25 per cent., and the master mechanic of one the largest railroads in the country claims 55 per cent) found in nearly all coal, such as sulphur, slate and earthy substances which are incombustible and retard, instead of generating heat, the difference in the per cent. obtained in actual practice is far greater than shown by the above comparison. There is also in coal a large percentage of loss in transportation and combustion in the heap, varying from 5 to 10 per cent. From these facts we can safely conclude that the heating capacity of oil is nearly twice that of coal as generally used.

On this basis the only question to be considered is the cost of power furnished by each at the dynamo. Three and one-half barrels, or 955 pounds of oil, equal 2,240 pounds of pure coal, therefore, with oil at $1 per barrel and coal $3.50 per ton, or oil at $1.50 per barrel and coal at $4.50, the difference would not be so marked if there were no other factors to be considered. When, however, we calculate the great saving in stoking, removing cinders and ashes, cleaning flues and benefit to boilers, besides securing a steady heat, combined with the quickness and ease in starting and shutting down, we have an argument in favor of oil, that stockholders who care for dividends can appreciate.

I have found upon investigation, that oil can be delivered at my station for $1.05 per barrel, while soft coal costs $4.50 and hard $6.00 per ton. On this basis, allowing five pounds of coal per hour, twelve hours per day, 1,000 h. p., requiring 803 tons per month at $4.50 would cost $3,613.50. Two firemen to feed same $100.00; man cleaning flues, etc., $45.00; carting ashes and cinders, $100.00; making total cost for thirty days, $3,858 50 with coal. Same number of h. p., and same length of time, allowing three and one-half barrels for each ton of coal, would require 2,810 barrels of oil at $1.05. This would equal $2,950.50 Wages of one man in boiler room, $50.00, making total of cost of 1000 h. p., one month, with oil, $3,000.50. Showing a saving of $858 per month, in above item, besides getting with oil a steady flow of steam, thereby producing that great consideration, regularity of speed. This is absolutely necessary in order to produce a perfect light, and will save in addition the wear and tear of the manager's nerves, as fluttering and jumping in unison with the spasmodic light, he stretches the third commandment to its utmost capacity.

If you are now burning coal, it will be necessary to equip your station with tanks, burners, cylinders, oil pumps, compressors, air receivers and additional apparatus, varying according to the number and size of boilers used.

During the past few months the following facts have been gleaned from an extensive correspondence on this subject with parties who are using liquid fuel: The Boston & Albany Railroad Company, after a careful test made in their shops by a Lehigh University professor, say that the cost of fuel is about the same. Though they purchase their coal in large quantities at one time and secure low rates, they prefer liquid fuel, because it is clean and requires no fireman and gives a better supply of steam. Day Cordage Company of Boston, claim that with Cumberland coal at $4.50 per ton and liquid fuel at $1.15 per barrel, they save 15 cents per 100 horse-power per hour, and the oil is preferable. The Fairbanks Scale Company, of Vermont, report that they find it a great saving over coal, while the boilers are heated evenly, the entire length; also, that the insurance companies have not increased their rates. T. P. Brown, manager of the Toledo, Columbus & Southern Railway, reports a saving of thirty-three per cent of the price of coal, by using liquid fuel; also, that two barrels of oil equal one ton of soft coal, while manufacturers on his road find it only costs one-half as much as coal for their stationary boilers. The Rolling Mill works of this city (Chicago) use it under a battery of fourteen boilers, and say that three and six-tenths barrels of oil does the work of one ton of coal. The cost of oil is less than coal, but the great saving is in labor for stoking, wheeling ashes and unloading coal. Formerly when using coal, twenty-five men were required to operate this battery of boilers for twenty-four hours; now with liquid fuel four men accomplish the same work. The efficiency of the boilers is increased, and cost of repairs lessened, while oil flame is less severe upon the boilers. Reference could be made if necessary to hundreds of persons who have had practical experience in burning oil, fully sustaining the facts given above, proving conclusively that liquid fuel is at least one-third cheaper than coal, and it is destined to be the fuel of the future.

I have thus far shown the benefits to be derived by using liquid fuel. It is, however, necessary to consider many points before deciding to adopt it, especially if your plant is in the centre of a large city with other property in close proximity. Managers of insurance companies are just cranky enough to believe that oil will burn, and unreasonable enough to object to your exposing and destroying property for which they have to pay, thus burying their dividends in the same pit you are trying to avoid.

Therefore they insist upon certain conditions before they consent to its use. Among other things, demanding that you store your oil 50 or 100 feet away from your station. If this should happen to place your oil tank adjacent to your neighbor's property, you will have the officers of the insurance companies whose policies cover his buildings, operating in a way that will drive grounds, short circuits and underground wires, out of your minds for a month. If necessary precautions are taken, and the apparatus is properly and securely arranged, there is no more danger with liquid fuel than coal. In fact it may be made safer, and insurance companies will permit its use without an extra charge for the privilege. Examine carefully, however, from an insurance standpoint, any apparatus offered you, before attempting to use it, or you may find that insurance is an expensive luxury, and operates fully as disastrously upon dividends as coal.

An iron tank will be required for storage of oil, which should be located under ground 100 feet from your station. This tank, if 16 feet in diameter and 8 feet in height, will hold 250 barrels. If 20 feet in diameter and 14 feet in height, 600 barrels. A pipe from this must pass under ground to the car, for unloading the oil by gravity, if practical, if not, by pumping. A second iron tank, holding enough oil for one day's use only, can be placed immediately outside the boiler-house, with a safety pipe, 1½ inches in diameter, extending 10 feet into the air, to permit the escape of gas. This tank must be connected with a large tank by an underground pipe for the purpose of forcing the oil into the smaller one, with another pipe for an overflow, to carry the oil back or away in case the pump is neglected or left running. The small tank must be lower than the burners or furnace, so that in case of accident the oil will flow back to the tank. In all pipes there must be stopcocks that will cut off communication between the burners and tank. The supply pipe at the boilers should be arranged with a valve not over one-half an inch in diameter, so that oil cannot under any circumstances be forced under the boilers faster than same is consumed by the burners, thus preventing an overflow from flooding the fire-box. There must also be an escape pipe extending outside the building for cleaning the tubes. In no case must the oil be allowed to flow from the tank to the burners by gravity, but must be supplied either by vacuum process, steam or compressed air. For this there are several plans: One is to force steam across the opening of a vertical pipe from the tank, and thus draw the oil up to the mouth of the furnace. Another is to use compressed air for atomizing the oil, and passing it to the burners. Others still use a retort and generate a gas. Unless the apparatus used is expressly arranged for starting the fire, oil must not be turned on until the burners are heated, for if it is, flashes and explosions will follow. If a station is furnished according to above conditions, the insurance companies will insure it without extra charge. If not, they will demand from fifty cents to two dollars extra, for every hundred dollars insured, according to any deficiency that may exist; while if the burners are fed by gravity, it is a prohibited risk.

Faraday has stated that the chemical action of a grain of water upon four grains of zinc can evolve electricity equal in quantity to that of a powerful thunderstorm. The Springfield (Ohio) Electric Light Company found, by a practical experiment made last December, that a small quantity of petroleum, under certain conditions, could evolve a sufficient amount of flame to annihilate an electric light station without any thunderstorm. They placed a storage tank holding 160 barrels in the basement of the main building, and another in the boiler-house containing the supply for daily use. From the last tank the oil was carried to the fires by gravity, and here was the cause of the fire. Having received a fresh supply of oil, they filled the large tank under the building, then turned the oil into the small tank in the boiler-room, and left the pump working while the men were busy in another part of the station. It overflowed the tank, and the oil escaped into the furnace, with the usual results following from gravity pressure, less oil, less building and less lights, with insurance managers running wild over the hazard of electric light buildings. Is it any wonder insurance companies object to assuming such hazards? Holmes has said, "That science is a first-rate piece of furniture for a man's upper chamber, if he has common sense on the ground floor," but if he has not got plenty of good common sense, the more science or more liquid fuel he has the worse for him. An electric light station can be made just as safe and secure as any mercantile risk, and insured at the same rate.

It behooves the members of this association to investigate this subject and correct the errors of the past, if they do not wish all electric light plants placed upon the prohibited list. For why should the most powerful and magnificent system for the protection of mankind, known as insurance, and the youngest child of science, electric light, appear as antagonists upon the world's

arena? Now, gentlemen of the National Electric Light Association, as there is no State in the United States, and few counties, that has not a town called "Franklin," so in the no distant future there shall not be a city, village or hamlet where the current which leaped to earth at his command shall not be utilized in that most wonderful invention of modern science, the electric light—an invention which is daily fulfilling Goethe's last prophetic cry, "More light! more light!"

Col. C. M. Ransom then read the following paper on

THE ADVANTAGES OF OIL AS A FUEL.

The use of oil as fuel for the purpose of producing steam is still in a certain sense an experiment, and yet it is no longer a question of whether it shall be used but merely a question of the manner and method to be adopted. The general public opinion seems to be that oil must, to a great extent at least, take the place of coal as fuel. The advantages are so obvious that it is hard to find a man who does not believe that some method will be found by which a steady, smokeless, economical and easily controlled flame can be produced from oil by means of which boilers can be heated in a much more satisfactory way than is now done with coal. The great public is tired of coal, with its clinkers, smoke, dust and ashes and the necessity of constant attention, not to say anything of the regular "corners," short weight and extortionate prices.

A large part of this feeling is due to the wonderful development of oil fields and the evident fact that oil can readily be furnished at about half the present prices. The Standard Oil Co. in combination with the Producers' Association are struggling to maintain the price at a high figure, but the very fact that in order to do so they are holding back a reserve stock of millions of barrels which they can at any moment throw upon the market makes speculators and simply postpones the inevitable result, cheap oil and plenty of it. Meanwhile the California oil wells are extending, and aside from the Pennsylvania and Ohio fields, new fields of large extent are discovered in Wyoming Territory and in other sections of the country,—to say nothing of the large oil fields of Canada. The export trade for oil is becoming less and is likely to cease entirely on account of the refineries erected by the Nobel Bros., in Baku, Russia. Hitherto the petroleum found in Russia has been to a great extent neglected, yet the production is said to be so enormous that the daily output of one well in Baku exceeds the daily production of all the wells in Pennsylvania combined. Quite recently Nobel Brothers have taken hold of the business and have erected extensive refineries, and are understood to be constructing pipe lines which must result in cutting off all the export trade in oil to Europe, and in throwing back upon the home market all the oil which would otherwise be exported.

In connection with the subject of oil as a fuel in steam making, some points may be stated which are doubtless familiar to most of the members of this association. The term "Crude" is applied usually to both the Ohio and Pennsylvania products, but there is a vital distinction. The Pennsylvania *crude* is really worth more than the lower grades of refined oil produced from it, on account of the value of the paraffine, vaseline, lubricating oil, etc., produced from the residue after the lower grade of refined is taken off, mainly by simple distillation. Of course, when the higher grades of refined oil, such as the "Astral," are produced, the additional processes required for purifying render the oil more expensive, but as a matter of fact the residue is really worth more than the distillation. The consequence of this fact is that no Pennsylvania crude is used as fuel so far as we can learn. The Ohio oil, however, stands on a different basis. No process has yet been discovered by which a refined oil fit to be used in lamps can be produced from the Ohio crude. We are informed that large prizes have been offered by the Standard Oil Company for the discovery of any process by which it can be done, and that this company has expended large sums of money in trying to do it, but has so far failed. The consequence of this has been an accumulation of over twelve millions of barrels of surplus stock of Ohio oil for which the market is simply for fuel, and so limited that it will not take the oil produced, to say nothing of the surplus. The fact that the residue after distillation is worth more than the distillation is especially true of this oil, and it is stated on high authority that the oil companies could easily afford to sell the distilled product at one cent a gallon and still make money from the residue. In their efforts to produce refined oil from the Ohio crude the Standard Company have accumulated several million barrels of a distillate which is not refined and which can be used as fuel if a proper apparatus is devised, but for which there is no large market to day, and which cannot be sold for use in lamps or kerosene stoves. It is inevitable that these vast quantities of oil must be thrown upon the market and that the price of oil must go down to a point far below the present one.

It gives one an impressive idea of the magnitude of the commerce of this country to reflect that probably nine-tenths of the vast quantities of oil sold in this country, and upon which such vast fortunes have been made, has been and still is used simply in kerosene lamps and stoves. The quantity of heat which can be developed by one pound of pure carbon is sufficient to boil 15 pounds of water from at least 212 degrees Fahrenheit if none of the heat was lost, and one pound of coal of fine quality under similar conditions will evaporate 14 pounds of water, producing 14.133 heat units. The total heat units which can be produced from one pound of petroleum are 27.531, and one pound of petroleum can be made to evaporate 285 pounds of water. These figures are taken from the work on steam boilers of Prof. G. B. N. Tower, formerly Chief Engineer of the United States Navy, and are believed to be reliable. In fact, other authorities seem to correspond.

The heat-producing value of petroleum compared with pure carbon is as 28 to 15, and compared with a fine quality of coal as 28 to 14, or 2 to 1, and 1,000 pounds of petroleum are equal to a ton of coal. As petroleum weighs 6½ pounds to the gallon 154 gallons are equal in heat-producing power to a ton of the present coal.

In practice, however, the heat-producing power of coal as used under boilers is very much less than the possible production stated.

Referring again to Professor Tower's work, we find that in actual careful tests of over forty different varieties of coal, the highest evaporation reached was 10.7, and the other results varied from 6 upward, showing a loss from the estimated possible result of from 30 per cent. to 60 per cent. We have been unable to learn of a single instance in which a higher vapor than 10.7 has been reached with coal, and have learned of only a few special tests in which an evaporation of over 9 has been reached. Such results have been reached only with exceptionally good boilers, with feed water heaters, and the best of modern appliances to utilize all the heat, avoid radiation, etc., and with the best of coal and the most careful handling. In regular use, however, even in improved horizontal tubular boilers with all improvements, the usual evaporation is from 7½ to 8½ pounds of water per pound of coal used, and in ordinary vertical tubular boilers the evaporation rarely exceeds 6 pounds of water to the pound of coal and is oftener less than more. All these facts must be taken into account in considering the question of the possible value of petroleum as a fuel. Coal has been the universal fuel and steam boilers are specially adapted and built for its use. Devices for producing perfect combustion of coal and for utilizing the heat derived from it have been patented by the thousand, and constant familiarity with its use in manifold ways has produced about as good a result with coal as we could well hope to reach, and this result summed up is that whereas one pound of coal can be made in laboratory practice to evaporate 14 pounds of water, yet in common use in good horizontal boilers the average evaporation is but 8, showing a loss of 43 per cent., and in common use in upright tubular boilers the average evaporation is only 6, showing a loss of 60 per cent.

Reverting to our former figures it is evident that if one pound of oil is equal to two pounds of coal, under laboratory tests where one pound of coal evaporates 15 pounds of water, and 154 gallons of oil equal one ton of coal, then when there is a loss of 43 per cent, on the heat-producing power of coal as in horizontal tubular boilers, 88 gallons of oil (if there was no loss in using it) are equal to a ton of coal, and in upright tubular boilers, where there is a loss of 60 per cent. in using coal, 62 gallons of oil (if there was no loss in using it) are equal to one ton of coal. It is evident that if such results as these could be accomplished and other objections overcome oil would be in universal use. Whether such results can be reached or not is difficult to predict. Inventions in the line of apparatus for burning oil to produce steam are comparatively recent. Nearly all of the inventions are in the line of atomizing or injector burners, and there are probably few, if any, horizontal tubular boilers in which oil is used as a fuel with any but an atomizer or injector. Burners of that description and of one peculiar form or another have been in use for several years. There is probably but little to choose between the different varieties.

The Cincinnati Spring Company wrote last June that they had probably used upwards of 10,000 barrels of crude petroleum with atomizing burners and preferred it to coal, and that they have tried all kinds of injector burners, but make one of their own that suits them better. The Michigan Bolt and Nut Works, of Detroit, wrote on May 14 last: "We tried the "Askins," the "Chicago Edwards" and a simply constructed burner of our own, using gas pipe, and we liked ours as well as any." Studebaker Bros.' Manufacturing Company, of South Bend, Ind., wrote, on May 14 last: "We have not yet determined what make of burners is the best. We have had about as good results with one we made in our own shops as with any." Of this class of burners, there are many varieties in use with more or less success. In brick making and certain classes of furnaces they seem to be regarded as being very satisfactory.

There have been, however, some serious objections to their use in boilers. In the first place, it is always necessary to make a fire in some other way first in order to produce a sufficient pressure of steam to start the burners, and it seems generally the case that they will not work on less than a 30 pound pressure. One of the consequences is that if the steam happens to run down it can only be raised again by shutting off the oil and making a fire of coal and wood. They are therefore of no use except where a long continued high pressure and a constant fire is maintained. Another difficulty with that class of burners is that their practical use seems to be limited to horizontal tubular boilers where the flame can be allowed to shoot through a long distance without coming in contact with the iron, the flame being thrown generally upon or against fire-brick.

Messrs. Keasley & Mattison, the celebrated chemists of Ambler, Pa., say: "The furnace must be lined with fire-brick, and satisfactory results can then only be obtained after the fire-brick reaches a' white heat.' The fact seems to be that in the atomizing process the oil is sprayed in small globules, and if these globules strike a cool surface, or one not excessively hot, before they are entirely consumed, the result is imperfect combustion and a large amount of smoke. This peculiarity of injector burners seems to render their use impossible in locomotives or vertical tubular boilers. In fact, I have seen letters from at least seventy different leading firms and well-known companies, located in almost every part of the country, stating in almost every instance that while they knew of injector burners, etc., they never knew or heard of an apparatus for burning oil under boilers which did not require the use of steam or compressed air—nor did they know, nor had they heard, of any apparatus whatever for burning oil used successfully under vertical tubular boilers. I have also seen a letter from the manager of the Fuel Oil Department of the Standard Oil Company, stating that he knew of only one burner which could be used under vertical tubular boilers. It is also a fact, I believe, that no burner has yet been brought into general use under house-heating furnaces. I believe it is now generally conceded that the use of atomizing or injector burners cannot be extended to embrace either vertical tubular boilers or boilers of the locomotive or portable type, or even horizontal tubulars below 50 h. p. In fact the system of atomizing does not appear scientific. It seems upon its face a crude and clumsy way of producing combustion. I believe, however, that the members of this association recognize few impossibilities and certainly are quite convinced that a device can be made by which oil can be burned and which can be easily and perhaps automatically controlled; and it would seem that such an apparatus would go a long way towards solving the problem of isolated lighting. For such a device we must, I think, turn to the system of converting the oil into gas first and then burning it. It seems to me such a system is in accord with the principles of science, and that in no other way can the best results be obtained from the oil. Of this class of devices the greater number have consisted of coils of pipe maintained at a high heat, at which the oil is vaporized and from which the vapor or gas issues in jets and is burned. These coils of pipe, however, I think, without exception, have proved failures because of the coking or accumulation of sediment. Attempts have also been made to burn oil and water together, which have so far proved unsuccessful, chiefly because of the great difficulty in adjustment and because they have been too complicated. Another defect has been that the vapor issuing from the tubes produced a smoky flame of comparatively small heating power. Still another difficulty has existed in the fact that if by carelessness the valves were opened too far, the oil would overflow the burner and flood the ash-pit.

Some time since my attention was called to an oil burner of the vaporizing type which was submitted to several eminent scientists and to a number of practical men and was approved by them. In that burner the oil was first turned into gas and then gas issuing in small jets was mixed with air before combustion, upon the general principle of the Bunsen burner. The result produced was a steady flame, entirely smokeless, and in some parts the flame was a most intense blue. The flame produced was regular and of large volume. The cylinder was large and capable of producing more gas from the oil than could be discharged under light pressure through the jet holes, and the tank was elevated so as to give a gravity pressure of about four or five pounds to the square inch. The result was that the gas stood in the cylinder at an even pressure exactly equal to the gravity pressure, maintaining the steadiness of the flame, and no oil would flow into the generator except as the pressure was lessened by the consumption of the gas, even when the fuel valve was opened wide.

Whether that particular device was, or is, the best or not, it seems to me that some device constructed upon that line must produce the best results attainable, viz.: The oil should be turned into gas and the gas burned after an admixture with air upon the same principle as ordinary gas is burned in stoves. Some of the advantages which a successful apparatus for burning oil would have are easily understood, and are: steady flame, perfect control, slight draft required, the power to increase or decrease the flame at will by the simply turning of a valve, the power to maintain steam at a steady pressure, the slight attention required, the power to instantly extinguish the fire without waste, the uniform heat, no reduction of fire or pressure when replenishing the fire, cleanliness, safety, economy in labor, no dust, cinders or ashes, less room required to store the fuel, and only one-third the weight.

With these advantages to be derived from the use of oil as fuel, it seems only reasonable to expect that within the near future some successful apparatus will be brought into general use for manufacturing and house heating purposes.

MR. LEONARD: I do not suppose there is any member of this association more interested in this subject than I am. We are pioneer users in the Northwest of oil, and I have listened with a great deal of interest to these papers—the paper of Mr. Francisco and that of Col. Ransom. While I do not exactly agree with some of the statements made in them, especially on the question of insurance, at the same time there are some excellent points. In the first place, the question of insurance is the only bugbear with us at present that we have to contend with. The other troubles we think we have overcome. As I stated, to comply with the requirements of the insurance companies would make the use of oil almost prohibitory. Mr. Francisco states that by the introduction of air pumps for creating a vacuum, making somewhat of a complicated apparatus, and by the storage of your tanks 50 feet away from your building, you can use it. I think it a great mistake. I believe that oil can be introduced and used under a gravity pressure with as much safety, if not more so, than you can by pumping it. He quotes the Springfield, O., fire as being an example to a certain extent of feeding by gravity. I had the pleasure of a short conversation with the manager of that station not long since, and I was specially interested in that, as just before leaving home, the insurance agent informed me that a policy of one of his companies was canceled. I asked him why: "Well, they will not insure because you feed by gravity." I said: "All right, I don't care." In my conversation with the manager of that company, I asked him what his arrangement was. He stated that his storage tank was underground, and also under the building—in the building practically; that his supply tank was above ground, holding, I think, 24 barrels or thereabouts; that tank was also in the building. An oil pump was used to pump the oil from his tank cars into his storage tank, and also into his supply tank. The supply tank was an upright tank, and on the top of it was a manhole which was left open at times. The pumping of this oil necessarily stirred it up more or less and created a great deal of gas; it will do that every time. The gas escaped from this manhole, and the building was more or less filled with it. The oil, as Mr. Francisco said, overflowed and came out through this manhole. Gravity had nothing special to do with it, that is, as to being used for feeding his boilers. It overflowed and ran down the tank and ran over the floor to a lighted lantern that was left by one of the employés of the company; naturally it caught fire, and the result was that they had a bad fire and abandoned the use of oil as being impracticable for steam-making purposes; not entirely for that alone, though as he informed me that he also received considerable damage to his boilers. The only thing that surprised me was that he had not burned up long ago. He had a regular fire trap there, and it was only a question of time when the accident that happened to him was bound to come. Now, I claim that the use of that oil should not be condemned generally by insurance companies because one man has it put in by a very poor arrangement. We have studied the case very carefully, and I believe, and I know, if the opinion of insurance men can be counted as good for anything, that our entire building could be burned to the ground and not the least particle of damage be done to our oil apparatus and our oil storage tank. We have a capacity of about 26,000 gallons in two tanks; they are 8 feet in diameter and 30 feet long, placed underground, as I stated, about 25 feet from our building, walled up on the side, imbedded in solid masonry and arched over at the top with brick. We have a space between the two tanks of about six feet, giving plenty of room for a man to go down there. We have valves at the opening of the tanks where the oil is admitted to the supply pipe and can be cut off there; at the entrance to the building there is another valve where it can be cut off; as it flows along the supply pipes there is another valve, and before it gets into the building there is another valve, making four valves before the oil reaches the burner, so that I still claim that the condemnation by insurance companies of the use of oil on general principles, because this man or that man has a poor arrangement and has burned up a station by the use of it, is all wrong.

MR. LOCKWOOD: I have listened to the papers upon this subject and to the discussion with a great deal of interest. The company which I represent in Detroit have been using crude oil since the first of July last, and we have used it continuously. We use the steam pressure. I think when Mr. Francisco states in his paper that the gravity system was by far the most dangerous and would not be allowed, he evidently believed what he said; but I think he made a great mistake. I think the question to be determined is which is the safest, that is the question of which would allow the most oil to escape through a break or a leak in a pipe in a given time. In running by the gravity system our small tank, which brings the oil to the burners under the boilers direct by gravity, has a capacity of about one barrel per hour; and we have two pumps, so we have always on hand oil enough to run the heaviest part of the day which would run about one barrel per hour. In the light part of the day that same amount of oil would last three or four hours. Now, one hour in the heavy part of the day is enough to repair your pumps if you have an extra pump on hand; and running as we are, we have never had the slightest trouble, and I know that if a leak occurred in one of our pipes, there would be a far less amount of oil worked out through that leak in a given time than if we used a pressure, as the pressure system used, I believe, would be ten pounds to the square inch at least. Now the manager of one of the largest insurance companies came to our plant and examined it thoroughly. That subject came up. He was under the impression that the pressure system was the only safe one; but he finally changed his mind and said that he would recommend in the future that the gravity system be employed, and with a small tank which furnished the oil be limited to one barrel per boiler per hour, and that would give capacity enough. Our plant is different in one respect from any that has been spoken of, inasmuch that the large tank, although under the ground, is within one foot of our building, and we are right in the heart of the city of Detroit. And still, as close as we are to other buildings with the capacity that we have there, the company only charges us 20 cents additional rate of insurance, and still we use the gravity system. We have been using that since July last, and have had no trouble, and even with that small capacity to feed the boilers we can always get our extra pump to use in case one pump gives out, so that we will not be out of oil. Mr. Francisco spoke of a case where the tank had overflowed by gravity and caused a fire. If that had been arranged as we have ours arranged in Detroit that would have been an impossibility. We feed from the large tank under the ground to the upper one by means of a pump, and the pipe is only a one-inch pipe. We have from the upper tank returning to the lower a three-inch overflow pipe, and the three-inch overflow pipe will carry more oil than the maximum capacity of the pumps that pump up the oil. Second, if the oil is allowed to rise too high, it can do nothing more than simply to return to the tank from which it is pumped. Our tanks are, with this one exception connected with the one-inch pipe which rises to the top of our building and gives vent to the gas. We also

have connected with it one other safeguard which I think is a necessity, that is the pipe feeding the oil from the small tank to the burner is connected at the level of our floor with the overflow pipe returning to the large tank, with a cock opening valve, so in the event of fire, if this valve is opened, in less than two minutes every bit of oil in the building within the small pipes will be thrown back to the large tanks.

And the insurance inspectors have approved that system, and only charge us 20 cents additional to the old rate. Our oil costs us 60 cents per barrel delivered in our tanks. The coal we used before was soft slack, and it cost, during the different periods of the year, from $1.90 to $2.10 per ton. I have found it upon close investigation and close analysis to be about the same expense for oil as the coal was, but I find it to be a saving in the way of convenience, as we have had two or three cases in the last six months where it was of the greatest necessity to the employés to stop suddenly; with the oil we have been able to shut off in an instant, and to resume again without any loss of time.

Now, I would like to ask a question. Each of the gentlemen has spoken of the evaporative power of oil as compared with coal, but they have left out one question. In coal the total amount of water evaporated is used for effective work; in oil part of it is used in the pressure. I would like to ask if any of these gentlemen have any definite information as to how much this water evaporated by the oil is used in the pressure.

Mr. FRANCISCO: I have been inspector general, inspector and general agent and adjuster of insurance companies for 25 years. That was my business until I took up the electric light business; in fact, I am in it now. I think I can safely speak in regard to the insurance of goods. I have consulted nearly every one of the prominent companies of the country in regard to this very question, and in regard to these various points that I have developed in my paper. The insurance companies' managers have told me that if the electric light folks would adopt the plan I have proposed they would insure them, but if they did not, they would charge them as I have specified. Now I am president myself of the Underwriters' Association of our State, and therefore I think I know what I am speaking about when I talk about insurance. In regard to the Springfield matter, I wrote the manager of the Springfield paper about insurance. I wanted to know what the cause of that fire was, and especially as I purported to use this crude oil in my own station. He did not answer my letter. I then wrote a prominent man in Springfield, and anybody who knows the man will guarantee his authority good. He went there and made a personal examination of the situation, and got all the facts in regard to the fire, and it was just as I stated in this communication of mine, he puts it on paper and signs his name to it, and sends it to me; so my authority is clear, and I can rely on his statement.

Now, Mr. Leonard's theory about the valves and all that is all right. There is no objection to that. But the point comes just here; there are always a lot of fools around electric light stations, the same as everything else, so far as fire is concerned; and your station may have forty valves, but what good would it do to men situated in the other part of the building? What good would his valves do, if he had fifty of them, as long as there was no one to take charge of them? The place in Winsted, Connecticut, where they burn petroleum oil, which burned up here a while ago; the insurance was paid. Insurance companies get their information by sad experience, and they know what every one of these things come to. When they draw their check in five, ten or thirty days, as they have time and time again, they know just exactly what it costs to put petroleum fuel in that place. Now this Winsted matter; they were burning oil and fixed up in first-class shape; there they had steam pressure where they forced the oil from the vertical pipes; then they had an escape pipe for blowing out the sediment that always gathers in pipes, and a drip valve, or drip pipe running down from that to take out the sediment. In that case they had forty pounds of steam pressure on that pipe that was forcing this oil on these burners. What does that man do but go and unscrew that cap to let out that sediment—there was forty pounds pressure upon it—and the result was he had a two-inch stream of oil pouring into it with all that force, and anybody can tell what would be the result. That case was reported to the papers that it was an explosion of gas. After the loss was all settled I went down there to investigate that matter and find out what kind of gas it was, and finally the man there explained it to me and told me what he did.

Now there is an illustration that you have to guard against in this business, and you have to fix it so it is impossible to have those things happen, and in our experience as insurance men we are aware of such blunders, and we are looking out to see that they do not occur again. Now, my theory was to have that blow-pipe pass out of the building, so in case you have such a man as that and he wants to experiment let him explode it out into the air. This matter of insurance is a vital matter, as I said to-day. Although I am in the insurance business, it is very difficult for me to get insurance enough. They will not write insurance on my own station, and I have not been able to get enough insurance, notwithstanding I was right in the business. Now there are millions of dollars invested in electric light plants. It is all right so far as you get something back, but if a fire comes, and your station is wiped out, then where is your stockholders' money? If you have not got insurance, where are you? If you have, of course you are all right. Now, the question is, if the insurance companies go back on the electric companies and won't write insurance on their plants, what inducement or what argument are you going to produce to get capitalists to put money into electric light stations. I think these objections can be obviated in the manner I have supposed. Just before I left home Mr. Richards, the agent of one of the biggest companies in the country, to whom I offered the risk on my own station, which he declined, said he would not write them at any price. He came into my office. I said to Mr. Richards: "Why did you come up here? Didn't you expect to be kicked out when you came up here for refusing to write insurance on my own station?" He said, "Yes, but we cannot write them. I said, "Why?" "Well," he said, "to be candid with you, we don't know anything about them; therefore, we take the safe side and refuse them all." I took him through the station and explained the whole modus operandi to him, and after he got through, then I showed him this paper. He said, "I want you to send a copy of that paper to our company and we will investigate this matter, and if you will send it to the Insurance Exchange we will investigate this matter; and if the electric light folks wish to meet us, we will meet them at any time, and have a committee appointed to investigate this whole matter."

Now there is the basis of what you want to do. My suggestion is that this association appoint a committee to meet a committee of the insurance companies to investigate this matter, and put it upon the proper basis, and enlighten them upon this subject of electric plants. I claim that they are just as safe as mercantile risks. I have examined that subject, as I said, from the insurance company's standpoint, and I ought to know something about the insurance part of it, even if I do not know anything about the electric part.

Mr. LOCKWOOD: I simply stated a few moments since that our insurance in Detroit under the conditions that our plant has been erected was only increased 20 cents per $1,000, and what I now add is this: that when we put in our crude oil plant our insurance was very nearly expired. It did expire about three months since, and I have since renewed it, and renewed it at the same rate, and the result is that in the insurance, with the exception of paying at the rate of 20 cents for $1,000, I have no trouble now in placing our insurance as well and easily as I did before. In regard to the danger of using the gravity system, I think, as Mr. Francisco says, that it is simply a question of putting it where it is less liable to do damage by means of ignorant handling, and that resolves itself down into one question. In the event of a break occurring in the pipe, the valve being constantly open, or open by mistake, that allows the oil to escape, which is the most dangerous? Which will allow the greatest amount of oil to flow out in the shortest possible time? The gravity system, with a total capacity of only one barrel per hour and with the pressure of only one or two pounds, or the pressure system with from 10 to 40 pounds pressure.

The CHAIRMAN: A motion has been handed up for reconsideration of the motion to continue the committee on the New England Electric Exchange passed this afternoon. That motion is seconded. All who are in favor of that will signify the same by saying aye. The motion was reconsidered.

Mr. J. F. MORRISON then offered the following resolution: That a committee of five be appointed, with P. H. Alexander chairman, to recommend some means that would secure to the National Electric Light Association the advantage now enjoyed by the New England Electric Exchange regarding the pleasant business relations between the electric interests and the insurance interest, and report at the next meeting of the association. The motion was carried.

The CHAIRMAN: If the members will remain in session we will continue the meeting. We have a paper by Mr. A. C. Chenoweth, who is not present, on conduits and their material in relation to underground conductors. As the gentleman is not present the chair will take the liberty of ordering it printed in the proceedings.

Mr. F. H. Whipple then read a paper on

MUNICIPAL LIGHTING.

There are so many difficulties encountered in a proper consideration of the title of this paper that one does not embrace the suggestion to discourse upon it with enthusiasm. It is a subject seemingly rebellious to analysis, yet one that requires to be treated in language whose clearness is inexorable. In these times one writes and speaks to the multitude, and upon questions broad in their scope and far reaching in their effects, and ought never to shut himself up in any sort of Freemasonry of his own building. When an issue such as this presents itself to the electric light world for discussion it should be treated fairly and squarely, with intelligence and judgment, and without the heated arguments of business controversies.

"Municipal lighting," as generally considered, means the municipal ownership of the plant. I think this definition is erroneous, for the reason that the greater portion of the income of two-thirds of the electric companies of the country is derived from their public street lighting contracts. Of the total number of arc lights manufactured by private companies who are parties to a city contract, 68 per cent. are public lights, and are paid for by the municipalities. On the other hand, of the total number of arc lights upon the streets of the land, but one-third of one per cent. are owned and operated by municipalities. Therefore the logic of the subject is not confined entirely to the question of ownership. The issue, to my mind, is based as much upon the rental value of an arc lamp.

What is the rental value of an arc lamp? Statistics regarding the price paid by various cities are not lacking, but comparisons are worse than useless, for they seemingly go upon the principle that a light is a light, no matter what it lights, what it costs to produce it, whether it has good illuminating capacity, or whether the system be an inferior or superior one. The prices for light vary materially in different places, but I have been unable to see that they vary in accordance with any fixed relation to any other factors which would seem to have a bearing on the service. It may be truly said that nothing has an absolute value. It would be impossible to prove, on a general hypothesis, that fifty cents, or any other sum, is in any place the exact value of an arc light, but in this, as in all other cases, some price must be fixed.

In the staple articles of the world's production the law of supply and demand regulates prices, but as electric light companies, in their relations to city councils, act under influences individual in themselves, the case is very different. The price of light for commercial purposes is to some extent regulated by the fact that moderate prices materially increase the consumption, but in municipal lighting, the city, if it accepts the terms offered, generally pays the contracted price. It is, therefore, in many if not in most cases, a matter of comparative shrewdness of the officials on either side as to the price paid and the service rendered.

There are to-day in the United States 316 cities and towns whose streets are wholly or in part illuminated by electric lights furnished under a public contract. The highest price paid for an arc light of nominal 2,000 candle-power, burning all night, is $360. The lowest is $40. Between these two extremes there are 186 prices. Upon the moonlight schedule the maximum figure is $165; the minimum $50.

What makes these wide differences in price? Granted that in many places local conditions, excessive competition, or the absence of all competition have weight in determining the cost of production, what reason shall we give for the varying figures exhibited in a wide field of localities where the conditions are almost absolutely identical?

The average cost of all night public lighting in the United States to day is $121 per light; for schedule lighting $110. In 1885 the cost was on an average $167 per light for all night lighting and $125 for schedule lighting. In 1886 it was $160 and $125. In 1887 it was $130 and $117. In 1888 it was $129 and $114. Thus we find that the price of public lighting has been steadily decreasing for several years, and to a large extent within the past few months. Contracts that have been renewed since the last meeting of this association in September show a net reduction upon all night lighting of 23 per cent., and upon schedule lighting of 19 per cent. The general run has been from 15 to 33 per cent., but there are several cases reported where the reduction has exceeded 50 per cent. An increased contract price is rare, less than a dozen in the country so reporting, and the highest figure reached is 20 per cent., while the lowest is 8 per cent.

These statistics do not furnish any guide as to the rental value of an arc lamp. The price paid by one city is often twice as much as that paid by a neighboring city, yet one would scarcely wish to be quoted as saying that the cost of production was in the same relative proportion It is obviously worth more to produce a light in one place than in another, but is it worth twice as much? It will no doubt be said that different degrees of illuminating candle-power enter into the problem, but in my computations I have considered none but nominal 2,000 candle-power lights. Sometimes the area lighted is pushed forward in explanation, but this has no connection that I can see with the cost of the light itself.

There is really no basis fixed upon which to charge for public lighting, nor any general data by which a fair rate may be arrived at. I am, therefore, of the opinion that coincident with the discussion of ownership, should come that relating to the value of the light, for this is really the primal cause for so much agitation of municipal control.

When it comes to the question of ownership there are three parties in interest, the parent companies, who manufacture the material to be used, the local companies that have invested their capital in a business they have the natural right to make as lucrative as possible, and the public, represented in an intermediate capacity by municipal councils. Accordingly we find three separate and distinct views taken of the question, and we are forced to believe that all three are right from their standpoint. Of the three factors, the local companies are the only ones presenting a solid front. They are united in the expression that municipalties ought not to do their own lighting. In view of the constant decrease in the price of electric lighting previously shown, and the transitory periods of electrical machinery, the local companies are mechanically correct in their claim to be able to generate electricity as cheaply as a municipality. Many of the circumstances by reason of which the sentiment favorable to municipal ownership became prominent do not have force to-day. The new and improved formulæ and the cheapening processes of production private companies are able to take advantage of where municipalities would not. Compound and condensing engines have made it possible to reduce the cost of power; more light is produced from a less expenditure of energy; carbons have fallen from $50 and $60 to $8 and $10; it is no longer necessary to locate a station in the central and therefore the most expensive portion of a city, and more attention is being given to water-power. All these are contributory to the claim of the private companies that municipalities should not enter into an investment the extent of which they are ignorant of in the face of a declining market.

With the parent companies the effects of municipal ownership are just beginning to be appreciated. There is no doubt but these organizations will at no distant day be brought squarely to face the alternative of refusing to sell material to municipalities altogether or of going out of business. It has been their custom while acknowledging an unwritten obligation to protect their local companies, to consider that they are not bound by any special dispensation to refuse a sale when the opportunity presented itself. They are not prepared to say that it is inadvisable for a city to operate its own plant as long as the city already has the other fellow's system installed. When it comes to a city which has a private plant of this or that particular system, then this or that particular parent company is decidedly opposed to the city embarking in the business.

For these truly natural characteristics, capital is quickly bringing the parent companies to a halt. No company is large enough or financially strong enough to organize and operate the local companies necessary for the times. Therefore, it is local capital and local activity that is the mainstay of the parent companies. Capital is always nervous, and we can readily see that with the continued growth of a sentiment favorable to cities doing their own lighting, capital will not run any risks. It will not invest in a city or town where a community interest stares it in the face.

There is another reason why the municipal ownership of plants does not run parallel with the interest of manufacturing companies. In the case of the municipality the net result of a year's operation is public property, while it is to the interest of private corporations to keep within their own knowledge the actual outlays. A larger increase in the amount of goods required may also be expected from them than from municipalities. And from the exasperating incidents of carrying through a municipal deal, with its attendant train of demoralizing influences, every company would fain be freed. I do not believe there is a parent company in the country that has made money by selling plants to municipalities. I know some who have lost money, and I wonder that as a whole they are not ready to commit themselves unqualifiedly and negatively upon the subject of municipal ownership. The time is near when they will be forced to go upon record in this matter, but to-day they are vacillating and uncertain. They believe that in some cases it would be a manifest advantage for cities to own their plant, and in other cases just as manifest a disadvantage. They would like to have each case stand independently.

In considering this subject from the standpoint of the public servant, it becomes at once a question of advisability, to which is naturally attached, although seldom considered, the element of responsibility. The theory of the political economist is that the monopolies of service should be owned by the municipality, and all belong to the community. In European countries this idea is carried to a much further extent than in our own. In many English speaking communities the public service does not stop with light, water and transit, but municipal ownership often extends to the bath, the laundry and the bakery.

It has been more gradual in America, doubtless because the tendency of the times in all municipal governments is toward political aggrandisement, and that it inevitably leads to corruption and a debauchery of the public service. It has, therefore, become necessary to largely restrict the functions of the local governments by more general legislative bodies. In America, politics is the national characteristic, and the ordinary politician is only theoretically honest. He recognizes moral turpitude only to the extent of dreading exposure of his own backslidings, while, if he break the law, he nevertheless outwardly insists on the sanctity of the law. Municipal service can be, and ought to be, administered with quite as much freedom from corruption as when in the hands of private parties. But in few instances do we find it so administered. We are thus confronted with a condition, not a theory, and in the municipal ownership of electric light plants this condition is easy of demonstration. I believe I can truthfully say that the experience of city governments in this line has not been in all respects satisfactory. Starting out a year ago as the investigator for a large municipality, I have closely studied the workings of almost every city plant, and, with but one or two exceptions, I would not now commend their operation. The officials of the smaller towns where municipal plants have been installed, with an amount of crude ignorance of the subject that is truly appalling, do not hesitate to assert that they and the people are well satisfied with the experiment, but in the majority of cases these officials are in office largely through the machinations of rings, and it would not be in the line of policy for them to decry the schemes of their associates.

The illumination of towns by themselves is on the intermittent plan of lighting, the hours varying so that no basis for comparison can be arrived at. The average advocate misinforms the investigator by holding up to view the proposition that these cities are doing their lighting for a merely nominal cost, while his figures are really superficial and not entitled to support. They are figured on isolated conditions to suit the emergency, often with items charged to other departments for the sake of a plausible showing in the lighting account. On one occasion, where I was called upon to estimate the cost of all-night service for a large city, upon its merits, my figures were $92 per year with interest and depreciation, and that I think is not very far from the cost of an arc lamp in our average communities.

A strong claim is made that despite the prejudicial influence of politics that enter into their management, municipal stations have reduced the cost of public lighting in their localities over the contract system.

I have previously stated that the average present price of pub

lic lighting in the United States is $121 per arc lamp per year, burning all night, and $110 per lamp burning on schedule. The average cost to municipalities which are furnishing their own light is $76 for an all-night light, and $44 for what they term a schedule light. This schedule is deceptive, and does not provide for as many hours' lighting as the usual contract does. Therefore the latter suffers by comparison. It is often the case, also, that the light is furnished in connection with some other department which bears a portion of the interest and depreciation account. Free water power and sometimes so-called free attendance also enters into these figures and distorts them.

The only argument worthy of consideration in favor of municipalities doing their own lighting is that of cheapness, and emphasizes what I have said in a previous part of this paper, that an important question involved is the rental value of an arc lamp.

Municipalities have not yet succeeded in reducing the price of light abnormally below the average. I do not consider the fact of any weight that a city, by reason of its not being compelled to pay taxes, and because it has no profit to make, can manufacture light cheaper than a private company, for I expect that what it saves in this way will be counterbalanced by losses caused by the influences of its management.

Here arises the question of a personal financial responsibility. We have become accustomed to consider that all public business, being in a sense, everybody's, is really nobody's, and too often it is the case that a mere perfunctory public duty is performed for the sole sake of the salary attached to the office. Any business enterprise to be conducted successfully ought to be carried on by men who are financially interested in it, and who feel in their own pocket the cost of every expenditure. A city government cannot possibly take that view of it, even though its departments were paved with good intentions.

There is but one view, and that a conditional one, in which municipal ownership can be indorsed. If the expenses of the plant can be kept within reasonable bounds, if the management is in all respects such as you would commit your own private business to, if there are no outside prejudicial influences, then, from the standpoint of the public servant, it would be desirable for some cities to do their own lighting. Without these qualifications it would be inadvisable.

The price of public lighting has outstripped all other questions in the financial management of our cities. It has become if not the chief source of expense the greatest bone of contention, and the electric light companies that will observe the handwriting on the wall and meet the subject half way, will do much to dissipate this sentiment antagonistic to their interests. There is room for improvement in public lighting. Contracts are not made by people living in a millenium, but by the mingled good and bad as they are found in the business world and municipal councils, and as they probably will be found for some time to come. There are several sides to this as to all questions, and there is a happy medium. In this medium the electric light fraternity should clasp hands with the well-meaning and observant public servant and see to it that while fair profits are returned for the service rendered, a union of interests is formed, cordial in its nature, though commercial in its results, and there will then be no occasion for public sentiment manifesting itself in the municipal ownership of electric light plants.

Mr. A. R. Foote, of Cincinnati, then read the following paper:

MUNICIPAL OWNERSHIP OF COMMERCIAL MONOPOLIES.

Since the day when Hermes Mercurius Trismegistus went up into the Mount of Regeneration, with his son Tat——, to recite his secret sermon, it has been clear to all thinking minds, that by the use of terms the people are deceived. This subject should not be called "Municipal Ownership of Natural Monopolies." Its true name, designating accurately the economic principle which it advocates, is *Municipal Slavery*—a scheme to enslave capital and pauperize labor.

The economic principle advocated is not in accord with natural economic law; therefore, it is an obstruction to the progress of civilization.

You who are here assembled know that all progress is due, and must ever be due, to the discoveries of science being made available for the uses of man. There is but one science—the science of natural law. The nearer its devotees or investigators arrive to an understanding of natural law, the nearer they apprehend the truth. Actions guided by truth are the guarantors of benefactions.

You who have experimented, with great patience and at great cost, to discover the natural laws governing the generation and control of electric energy, know how impotent all your devices are to compel that energy to serve you, if they fail to comply with the conditions of those laws. The same fact is true in economic science. If economic policies do not correctly apprehend and comply with natural economic laws, then the effort made is impotent to secure the best economic results.

Public ownership of commercial monopolies is advocated upon the supposition that, if worked without a profit, the economic result will be a benefit to the people. Work without profit is slavery. That slavery is not an economic benefit is proven by the experience of all men in all ages.

A man is foolish that expends time and money in an attempt to invent a thing that he can find ready made. A community is foolish to undertake an economic policy that all the data of the human race proves to be wrong; a policy which, in the very nature of things, must be absolutely wrong.

That capital is entitled to a profit for its use and risk, is the foundation law of all economic science. There is not a recorded instance in the history of finance, where an interference with the operation of this law has secured a permanent benefit for the people. All evidence shows that, where this law is allowed to operate with the greatest certainty, there capital is most abundant, works on the smallest margin, and produces the most healthful progress.

Capital is the conserved energy of individual action; it never loses its individual character.

When the attempt was made to christianize communities by government authority, they remained barbarians. When communities attempt to become rich by operating commercial monopolies without a profit, they will be made paupers. Religion is individual rightness. Capital is individual energy, conserved for individual betterment. Civilization makes progress through individuals becoming better and richer.

A man's capital is his power to produce. Surplus is the product of energy in excess of the wants of life. Capital is the conserved energy of surplus. Surplus is an individual creation, and belongs by natural right to its creator. To abrogate the law of increase for use and risk, is to destroy the only economic inducement men have to create a surplus. Deny men the ownership of their surplus, and they are forever slaves. Deny men an increase for the use and risk of their surplus, and all the forces of progress will be forever paralyzed.

The application of these generalizations to the question before us is easy.

First. There is no municipal surplus, unless it is taken from the surplus of individuals by taxation. This makes the individual poorer.

Second. Working public monopolies for a profit is securing income by indirect taxation. Indirect taxation is a tax on consumption.

Third. When public monopolies are not worked for a profit, their products are sold at a reduced price. This compels all private capital to abandon the business undertaken by public monopoly. By this process, all the forces of progress for that industry are paralyzed.

Fourth. Every industry grows as long as it produces, or gives promise of producing, a profit for the use and risk of the surplus invested in it. When, for any reason, the hope of profit fails, the industry dies. Expectation of profit is the life of industry. Its growth is in ratio to the per cent. of profit promised, plus the certainty of securing it. In the beginning, surplus created in some older industry is transferred to a new undertaking to give it life. If the new undertaking fails to create a profit, it loses its power to draw life from other industries and dies. It has failed to demonstrate its right to exist. For this reason, that man who so orders the conditions under which an industry must be worked as to deprive it of the power to create a profit, is its murderer.

I know of no industry which has been developed to the best of which it is capable under public ownership.

This subject may be illustrated by reviewing the development of the gas lighting industry. Sixty-eight years ago, the first plant in the United States was installed in the city of Baltimore. To-day there are 1,000 plants in operation, which have cost about $500,000,000. If this industry had been worked under conditions depriving it of the power to create a profit, could this enormous capital have been collected by taxation? If not by what means would the cities of this country have obtained the benefits of gas lighting? This is not all. The power to create a profit, and the right to own the profit created, has proven a powerful stimulant to invention and improvement. By these processes, service has been improved and cost reduced, until the present price is but a fraction of the original charge. In 1878, the average price of gas in 290 cities was $3.15. In 1887, the average price for the same cities was $2, a decrease of 33 per cent. in 9 years. This process is still going on. The decrease in 1888 was in greater ratio than the average for the preceding 9 years.

Four gas plants are owned by municipalities—Philadelphia, Pa.; Richmond, Va.; Wheeling, W. Va., and Danville, Va. Not one of the inventions or improvements that have benefited service or cheapened cost have emanated from either of these plants. Neither of the older works is in line with the improvements of to-day. Richmond is now engaged in improving its plant. When the work is finished, as ordered, it will be in line with the improvements of ten years ago. One special point avoided in making changes, is the reduction of the number of employés. Is there any political significance in this? Philadelphia has just contracted with private capital to furnish 3,000,000 feet of gas per day to the City Gas Works. Why? Because the city can not make it for itself, as its works are not supplied with the necessary improvements.

A comparison of the price of gas in six cities:

	1878.	1888.	Per cent. of decrease.
New York	2.75	1.25	54½
Philadelphia	2.30	1.50	35
Baltimore	2.75	1.00	63½
Richmond	3.00	1.50	50
Cincinnati	2.25	1.15	49
Cleveland	2.50	1.00	60

But why give data and make comparisons that have no scientific value, because all the factors influencing the result are not considered? If public ownership is not founded on correct economic principles, then the result of such ownership cannot produce the best economic results.

Let us now consider the effect of public ownership on our own industry. It is acknowledged that no city has yet undertaken to supply its citizens with a complete electric service. If the industry is to be developed by public ownership, why do not these cities commence in line with the progress that has been made? If they have not the enterprise so to commence, can there be a reasonable hope that they will ever catch up, keep up, or contribute to the forward momentum? To-day, private capital is ready to install electric central stations having proper apparatus and sufficent capacity to perform the entire electric service of a city.

This service now includes arc and incandescent lamps for street lighting; arc and incandescent lamps for commercial lighting; incandescent lamps on meter measurement for domestic lighting; stationary motor service for all mechanical uses; motor power for operating street cars.

One of the largest companies manufacturing electrical apparatus has installed electrical central stations in about 160 cities. The combined capacity of these stations would fall far short of performing the entire electric service for the city of Chicago, if the service in that city was developed to the best of which it is capable. Can any one calculate the difference in cost of installation, operation, and administration between one station, combining the capacity of the whole and that of the 160 stations located in as many different cities? To-day, electricity is at its highest cost, and gas at its lowest cost. Gas has 50 years the start.

To supply a complete electric service to the cities of this country, in a manner now known to be practical and best, will require the investment of over $1,000,000,000. Do the manufacturers of electric apparatus expect this vast sum to be raised by successive tax levies? If not, then they must secure its accumulation through private ownership, operating all electric central stations for a profit. There can be no hope that the electric industry can reach the highest degree of prosperity of which it is capable if it is sold into slavery in its youth.

Fortunately for us our industry is not the only one needing defense against the promulgation of communistic theories.

Those who advocate such theories are consistent enough to push them far toward their logical conclusion. It is well that they do so, for it is the most helpful service they can render those who would resist the encroachments of their economic policy. In elaborating their theory they furnish all the proof needed to show its fallacies.

Professor Richard T. Ely, Ph.D. [Associate Professor of Political Economy in the Johns Hopkins University, Md.], may be recognized as chief in the school of communistic philosophy. By reading his books it is easy to see how, as he familiarized himself with the idea of public ownership, the list of so-called "Natural Monopolies" expanded, until by it he furnishes a logical reason why all industries should be so owned and operated, if any one of them should. A mere mention of the monopolies he recommends cities to buy will give a good idea of the progress he has made in communism.

They are as follows: gas supply; street car service; highways and streets; electric lighting; all railways; canals; bridges; light-houses; ferries; docks; harbors; natural navigations; postal service; telegraphs; telephones; abattoirs, or slaughter-houses; markets; union depots; express business.

This list illogically associates non-commercial with commercial undertakings. In it are embraced a large percentage of the industries of the country. If it is so desirable for the public to own so many, why specify? Why not own all industries?

It would be interesting to know what additions would be made to public investment, public income, public patronage, and to the number of public employés, if the recommendations of this economist were acted upon, and this entire list of undertakings were at once transferred to public ownership.

Could the party then in power ever be voted out?

This list is serviceable in another way: It shows the interests that should unite with us in combating communism.

In his address before the Boston Merchants' Association, at its annual banquet, Jan. 8, 1889, Professor Ely said:

"I say, then, that cities should pursue a policy looking to the ultimate ownership and management of all local monoplies. * * * This is most intimately connected with local taxation. One of two methods may be pursued.

First. These monopolies may be worked for a profit, and by profit taxes may be reduced; or,

Second. Charges may be reduced, and increased general prosperity will furnish a more plentiful source of taxes, and thus allow a reduction of the rate."

Profit on the products of public monopolies, is taxation on consumption. Taxation on consumption is indirect taxation.

Since Professor Ely recommends that gas lighting, electric lighting, street car service, and numerous other industries be owned by the public, and then operated for a profit to reduce taxation, it will be well to learn his views on indirect taxation. Here they are:

"Indirect taxes violate the principles of equity. * * * we import salt and tax it 50 per cent. of its value. Does the rich man consume more salt than the poor man? * * * We have in a tax like this, what is called a regressive tax, a tax which increases as income decreases—*the worst kind of a tax, and the most unjust.* * * * Indirect taxation does not discriminate between the last dollar of the poor widow and the dollar which is only one in an income of a million. It raises prices, reduces the value of income, and forces some who are already near the awful line of pauperism to cross it and thus puts to death higher aspirations in a class of citizens, and lowers the level of civilization. * * * Indirect taxes are imposed upon people without creating so much discontent as direct taxes, and without occasioning so close a scrutiny of the methods in which the proceeds of taxation are expended, because the mass of men do not realize that they pay taxes every time they purchase dry goods or groceries. Indirect taxes are an underhanded kind of taxation. It is not, then, surprising that they are, in the minds of many, identified with despotism and aristocracy, while there is a growing opposition to them on the part of enlightened democracy."*

It is not surprising, however, that an economist who sees the character of indirect taxation so clearly, should recommend those who are so oppressed to extend the list of oppressors from dry goods and groceries to gas lighting, electric lighting, car fares, and a long list of other things? Are the rich so poor that it is necessary for one penny out of every car fare paid by "the poor widow," should go to help reduce their taxes, or are they mean enough to want it done?

Suppose that all these industries were owned by the public, and the profits on them were sufficient to pay *all* the taxes, would not the payment of the tax be in inverse ratio to the income of those who pay it? Can any form of tax be more inequitable, more unjust? The short of the first proposal is, then, to tax the poor and relieve the rich. Who wants it done?

That which has been said about the slavery of capital is a sufficient answer to the second proposal.

He who assumes to be a scientist and a teacher, should be accurate. Professor Ely is reported to have said, without explanation, in his Boston address:

'Gas can be made and sold at a profit for 37 cents. I say it can be done, because it is done in the city of Philadelphia; parties supplying the city with gas at that figure."

What do you understand by that? Does it not convey to you the idea that the consumers of gas in Philadelphia are being supplied at 37 cents? Well, the truth is that the gas works are owned by the city. On account of not being supplied with all the latest improvements, the city has contracted with *private capital* to supply 3,000,000 feet of gas per day. This is a carbonated water gas of high candle power, and is mixed with the regular city coal gas for the purpose of increasing the output and improving the quality of the gas manufactured by the city works. The consumer of gas in Philadelphia pays $1.50 for his gas as before. This is held as a sample of the benefits of public ownership. This from a teacher of economic science!

Professor Ely presses his point still further, by saying: "It was the best citizens of Philadelphia who insisted that the gas works should remain city property when the gas trust expired."

What scientific or economic value has a reason like that? It is the argument of a politician, who knows that but few people analyze the meaning of words. From the fact that he is teaching that a tax of one penny in every street car fare "would relieve to that extent the business men of cities from their load of taxation," it is fair to presume that by "best citizens" he means the respectable wealthy people. *They know* that the $3,000,000 which they found in their budget of 1887, as receipts from gas ["Taxation in American States and Cities," page 271a], came by indirect taxation from the larger people who consumed most gas—the majority—who are poor. This is the reason why THEY insisted that the gas works should remain city property.

The "best people" of Jerusalem crucified Christ. The "best people" of Rome persecuted his disciples. The "best people" of the South held the laborer in bondage. The "F. F. V.'s" of Virginia hung John Brown, who tried to liberate the slave. The "best people" of England are to-day using the power of the government to crush the Irish people, whom they have pauperized. One of our "best citizens" is seeking to ease the burden of taxation for the rich, by collecting pennies from the poor, under cover of charges for gas lighting, electric lighting, street car fares and other products of industry. He advocates an economic theory which must result in the slavery of capital and the pauperization of the people.

Since the days of Hermes, by the use of terms, the people have been deceived.

The following paper was then read for Mr. A. C. Chenoweth on

CONDUITS, THEIR MATERIAL IN RELATION TO INSULATED CONDUCTORS.

I have the pleasure of presenting to this convention some observations in relation to sub-electrical conduits and insulated conductors. Many miles of structures of various kinds with insulated conductors in them are now to be seen in New York, Brooklyn, Philadelphia and other cities. While the conduits themselves do not present any very important signs of decay, the conductors have given evidence of decomposition in various stages, and many have given out entirely. Those covered with rubber compounds having given place to the same protected by a lead covering.

Very little attention has been given to the subject of electrochemistry, failure being attributed to various causes; remedies have been resorted to of a practical nature, suggested by mere circumstances, in order to counteract the supposed evil. That electro-dynamic forces have contributed to the trouble can hardly be denied. Creosoted wooden ducts and iron tubes are the prevailing forms of construction. Illuminating gas and moisture were found in most all of them. Rubber insulation was rapidly destroyed, and lead covered cables were corroded to such an extent in creosoted wooden ducts that other cables covered with an alloy of tin and lead were substituted, and even with these it was found necessary to coat with paint, hoping it would prevent any action from taking place. In the iron tubes corrosion was much slower.

After a careful examination of conduits and conductors, I am led to believe that this decomposition of insulation and covering is due to an electro-chemical decomposition.

The existence of thermo-electricity, or a natural voltaic arrangement in the earth is without doubt true. But the establishment of the principle that a certain electrolytic intensity is necessary before decomposition can be effected is of great importance to all those considerations which arise regarding the probable effect of the earth currents. For to produce an effect of decomposition or of combination, a current must not only exist but have a certain intensity before it can overcome the quiescent affinities opposed to it, otherwise it will be conducted producing no permanent chemical effect.

In electro-chemical decomposition, the effect is produced by a force either superadded to, or giving direction to, the ordinary chemical affinity of the bodies present. In this view the effect is considered essentially dependent upon mutual chemical affinity of the particles of opposite kinds. Bodies dependent on weak affinities very rarely give way. Take, for instance, glasses—those formed by silica and an alkali. It is evident that all cases in which decomposition does not occur may depend upon the want of conduction. This being true, good conductors should never be selected for conduits, such as iron. Metals, owing to their high conducting powers, make admirable "poles," and yield to electro-chemical decomposition. It is true that some of the metals would not be decomposed, as they are costly and not available for use. The subject I present must be settled by weight of evidence rather than by simple philosophical conclusions.

I call your attention to a piece of cable that was removed from a creosoted wooden conduit in Brooklyn. The lead covering was eaten full of holes; it had been down over a year, creosote was attributed as the cause of decomposition: illuminating gas and moisture were present in the ducts; it was reported a rubber compound insulation was destroyed in the same duct; examination was made of iron conduits with lead covered cables in them, and decomposition was plainly seen in various stages, although the lead covering was not so rapidly decomposed as it was in a cresosoted wooden duct; moisture and illuminating gas were present; the deposit on the surface of lead covered conductors proved to be carbonate of lead.

In pursuing this examination I found a peculiar case that deserves some consideration. I found exposed to view in a man-

*See "Taxation in American States and Cities."

hole a cable that was covered with an alloy of tin and lead; this cable had been down about four months; it passed through the manhole on into the duct; the part exposed to view was about seven feet; the duct was constructed of iron and cement. On one side considerable decomposition appeared, being very active for about two feet of the exposed part which rested on the bottom of the manhole. A large iron pipe for water traversed the manhole parallel to the cable. The crystals of decomposed lead extended over toward the iron pipe, being quite profuse, adhering to the brick and side of manhole. An examination of the white crystals proved it to be carbonate of lead. Moisture was present but no illuminating gas. I placed a piece of lead on the cable at this point; after two months I removed it and found the same covered with crystals of carbonate of lead, showing signs of electrolytic action, between the lead covered cables and iron pipe, traversing that manhole, moisture acting as the exciting liquid

I found in Brooklyn a cable that was conducted into a building some distance from a creosoted wooden duct; this cable was also decomposing in spots, while no odor of creosote or illuminating gas could be detected. The moisture may be the exciting agent, accelerated by creosote and illuminating gas. This action may be explained as caused by the reaction of the constituents of each portion of decomposable matter, affected as they are by the supervention of the electrical currents. Portions of the proximate or ultimate elements proceed in the direction of the current as far as they find matter of a contrary kind capable of affecting their transfer and being equally affected by them, and when they cease to find such matter they are evolved in a free state upon the surface of metals or air, bounding the extent of decomposable matter in the direction of the current. Hydraulic engineers frequently find an electrolytic action set up in stopcock valves under ground when they are made of two kinds of metals, the gate being brass, and main part of valve being of iron. Examination has shown that water impregnated with iron or saline matter has produced this action. I was informed by a very eminent engineer who is now chief of the Croton Aqueduct in New York City, that metals of different kinds underground invariably present marked evidences of decomposition when in contact. Faraday has shown that these electrolytic actions do not depend on contact alone.

In order to avoid any electro-chemical action, iron tubes, creosoted wooden ducts, or any material that can become the means of establishing this action, should be discarded for material neutral in its relations, like water, or triple silicate of lime, magnesia and aluminum, artificial stone. In case of pure water it is difficult of application, as the cable would have to be suspended in the water. Submarine cables last for a long time, except when they come in contact with certain soils, or meet with mechanical injury. It has been suggested to fill the conduits with water as water would absorb gas, changing its condition to an electrolyt, and establish an action with the metallic tubes for the purpose of holding it.

A triple silicate of lime, magnesia and alumina, artificial stone, are constituents which combined, form a substance more neutral than any other. The selection of this material for underground structures in form of concrete was probably the result of long experience rather than the knowledge of its material relations, as presented by electro-chemistry.

Attempts to counteract the electro-chemical action to a lead-covered cable by placing another substance in juxtaposition has not proved a preventative; it may delay it. Also the alloying of tin with lead. Metals may combine when melted together, but they do not remain combined after the solidification of the mass. I present here an example of this case. I refer to a piece of brass tube that was used for pneumatic transmission by the Western Union Company in New York, it being buried in a wooden box in one of the streets of New York. After it had been down some time it was so eaten full of holes that it required renewing. Upon examination you will find the zinc is eaten out, while the copper remains perfect; the action was on the outside, while inside the brass remained perfect; air traversed the inside continually while moisture and other causes produced an electro-chemical action that I do not think can be imitated by any known arrangement of conditions so as to leave the copper as shown in this example; thus showing the peculiar effect of the earth currents in decomposing the zinc in this alloy, then removing it entirely. Moisture and gases must be removed by ventilation. In order to accomplish this the diameter of the conduits should be not less than four inches, and some relative proportion be established between the diameter of the cable and diameter of the duct, otherwise the power required to force air through would be beyond an economic limit.

The subject of ventilation for electrical conduits not only becomes necessary in order to protect the conductor in them, but in order to protect life and property. Thursday, Dec. 20, 1888, an Edison man-hole exploded in Maiden Lane, New York City. Jan. 19, one month later, an explosion took place in Nassau street. November, an Edison manhole exploded in Boston. These explosions have been attributed to accumulation of gas.

With a proper observation of the facts set forth and remedies suggested, we can combine the manufacture of insulated conductors, with a structure that will protect the insulation rather than destroy it, producing a perfect system of underground sub-electrical conduits and conductors.

Dr. MOSES offered the following resolution, which was unanimously adopted:

Resolved, That the thanks of the National Electric Light Association be and are hereby tendered to the St. Louis Exposition and Music Hall Association, through Mr. David J. Harris, manager of the electrical exhibit, for the very cordial invitation of Feb. 19 for this association to hold its next convention in St. Louis, and the very generous offer of the use of the Exposition Hall, and of free exposition space for convention purposes; and be it further

Resolved, That it is with regret that the association is obliged to decline the invitation above named.

Mr. Morrison moved the reconsideration of the action by which the resolution for the appointment of a committee on state and municipal legislation was referred to the Executive Committee, in order that the appointment should be made by the chair. The motion was seconded and unanimously agreed to.

The CHAIRMAN: Before we adjourn the chair will appoint upon that committee under the resolution of Mr. Morrison in regard to the New England Exchange, Mr. Alexander, Chairman, and Messrs. Francisco, Cram, Woodbury and Perry.

Mr. MASON, Boston, offered the following resolutions, which were unanimously adopted.

Resolved, That the hearty thanks of the National Electric Light Association are hereby tendered to the Exposition Society for the valued courtesies extended by it to the association during its present session.

Resolved, That the National Electric Light Association desires to record its grateful appreciation of the valued and able services of Mr. B. E. Sunny, Chairman of the Executive Committee, who, by the exercise of rare executive ability, has so largely contributed to the success of the meeting in Chicago.

Mr. MASON also offered the following resolution:

Resolved, That a committee of five, of which Mr. Arthur Steuart shall be chairman, be appointed, whose duties shall be to report at the next session of the association a plan for the incorporation of this body.

Mr. MORRISON: I move that the resolution be laid upon the table and when the motion is properly before the meeting, I will give my reasons for it.

The CHAIRMAN: I would suggest that it be referred to a committee already appointed.

Mr. MORRISON: I withdraw that; I want action taken upon it at once. The reasons why the National Electric Light Association should not be an incorporated body are, first, because of its itineracy; second, it is a national association and should not have a State charter from any particular State, and third, that there is no object in the National Electric Light Association being incorporated, because we do not want to sue or be sued.

Mr. MASON: I offer this without any desire to press it further.

On being put to a vote it was lost.

The CHAIRMAN: If there is no other business before us, the chair desires to return his thanks to you for the courtesy and consideration you have extended to him, and to say that he will give to his successor all the support he is capable of during his new administration. If there is no other business, I declare this convention adjourned *sine die*.

The special Pullman vestibule train chartered by the New York members of the National Electric Light Association to convey them to Chicago, left New York on Sunday morning, February 17, and reached its destination next morning. There were about 60 in the party. Several gentlemen joined the party at Philadelphia and Pittsburgh, and received a hearty welcome from their brethren on the train. The train was entirely new throughout. It comprised three Pullman vestibule sleeping cars, a dining car and a magnificent combination car, the latter including a bath-room and barber-shop. Passenger Agent H. M. Haines declared that it was the finest train which had ever been sent out of New York. It was lighted throughout by electricity, the plant consisting of an Eikemeyer dynamo and Brotherhood engine being located in the baggage car. Messrs. J. H. Bunnell & Co. of this city installed the plant. Okonite wire is used throughout the train. One interesting point is that the two rear red signal lights on the train are electric lights, placed just as in a street car. The enterprise of the Pennsylvania Railroad in lighting many of their trains by electricity is to be commended.

The party was a very jolly one, and not less orderly. In the evening an entertainment was given under the able presidency of W. H. Johnstone, with Messrs. Cobb and Stump as door-keepers and sergeants at-arms. Each member of the party had to tell a story, sing a song or play the part of host, and thus the time was spent most agreeably until 1:30 A. M. when all sought the seclusion that a Pullman berth grants. A set of resolutions, signed by all on board, was presented to Messrs. Porter and Price for their trouble and success in organizing the trip.

EXHIBITS.

The Exposition building, located on Michigan avenue, at the foot of Adams, was the place chosen by the Executive Committee for the meetings and exhibits of the National Electrical Light Association. The exhibits exceeded in size and number any of the previous efforts in this direction, and the general appearance of the display as a whole was more like that of a special electric exhibition, such as the one held in Philadelphia in 1884, than the fragmentary samples of apparatus shown at previous meetings in the various rooms and parlors of hotels.

The Exposition Building is 1,000 feet long, and its average width is about 240 feet. The exhibits were in three different sections of the building—the large outer hall and Departments A and B.

On entering the large outer hall the first general features noticed were the Thomson-Houston electric railway, different patterns of mast arms, three engines running dynamos of different types, motors, storage batteries, electric cables, underground conduits, etc.

Department A was in a room opening into the main hall, and an idea of the exhibits there can be better obtained by a perusal of our itemized descriptions of these displays. The ear was greeted with the ringing of bells and the whizzing of dynamos, and the department seemed to contained almost everything electrical in actual operation.

Altogether this exhibit was a most brilliant success, and the general sentiment of those in attendance was one of regret that they could not spend more time in the inspection of details.

Going on to Department B the visitor passed through a rather narrow gangway of exhibits of every description. Brilliantly lighted electroliers illuminated displays of delicately tinted glass globes, non-magnetic watches, steam gauges, wire, belts, etc. The Press room was divided into booths, each bearing the name of the publication occupying it. This room soon became the focus of attention, both on account of its adjoining Convention Hall and the presence of the representatives of the electrical press.

The press was, as usual, well represented, and the various journals occupied a large room immediately adjoining the Convention Hall. Gaily festooned booths in the corners and along the walls contained the stands of the following journals: *The Western Electrician, The Electrical Engineer, Electric Power, The Electrical Review, Modern Light and Heat, Fire and Water, Science, Practical Electricity* and THE ELECTRICAL WORLD.

Copies of the special bulletins of THE ELECTRICAL WORLD were on hand and distributed a few hours after each session, containing a clear synopsis of the proceedings of the same day, and a complete list of electrical people in attendance at the convention. *The Western Electrician*, with noteworthy enterprise, also published a daily issue during the convention, containing a full report of each day's proceedings.

Convention Hall was beautifully decorated and brilliantly lighted with incandescent lamps of different systems and colors. The rostrum was under a canopy which was one blaze of light, and the letters, N. E. L. A., in colored lamps, hung on the wall facing the audience. The accommodations for the electrical and city press were well looked out for.

On Monday evening, Feb. 18, the local members of the Executive Committee, Messrs. B. E. Sunny, S. A. Barton and W. A. Kreidler, gave a fine banquet at the Union League Club House to the officers of the association and the other members of the committee, as well as representatives of the electrical press.

There were present: S. A. Duncan, president; B. E. Sunny, chairman of executive committee; A. V. Garratt, secretary and treasurer; A. J. De Camp, vice-president; Frank Ridlon, J. F. Morrison, Dr. Otto A. Moses, T. Carpenter Smith, E. F. Peck and W. A. Kreidler, executive committee; G. M. Phelps, *The Electrical Engineer;* Col. C. M. Ransom, *Modern Light and Heat;* C. W. Price, *Electrical Review;* J. W. Dickerson, *Western Electrician;* Clarence E. Stump, THE ELECTRICAL WORLD.

After dinner a meeting of the executive committee was held to make up the order of business for the guidance of the convention to hear committee reports and to pass upon the papers which had been submitted by their authors.

On Tuesday evening, Feb. 19, a reception was given by the Chicago Electric Club to attendants at the Convention, at the club quarters, 122-124 South Clark street. It lasted from five until after midnight and was extremely enjoyable, the members of the club doing all in their power to extend a hearty hospitality to the visitors. The club was crowded, and the utmost good feeling and joviality prevailed. A part of the evening's entertainment was a musical performance furnished by Señor Garcia, the leader of the well-known Mexican Orchestra. During the evening a handsome collation was served.

Upon Mr. F. N. Bosson fell much of the hard work of arranging the exhibition and supervising it in the various stages. In him Mr. Sunny found a good right hand, and his skill and judgment were warmly praised by all who had relations with him. The superintendent of such an exhibition had a heavy task to carry out, but he lost neither his head nor his temper, and gained the good will of everybody.

One of the acknowledged necessities of a convention is THE ELECTRICAL WORLD BULLETIN which has now been published at six successive meetings, namely, those of Detroit, Philadelphia, Boston, Pittsburgh, New York and Chicago. The success scored at Chicago was perhaps greater than upon any previous occasion. Owing to the extreme interest in the proceedings, and the fact that a great many members were unable to get into the meeting hall, there was the briskest kind of a demand for the bulletins, and the supply was proportionately large and prompt. No fewer than six editions were published, each coming right upon the heels of each session, and their usefulness as a medium for giving information was attested by the hundreds of requests for them, not only for reference, but for nightly mailing. The number of copies distributed reached several thousands. Since the management of the paper go to considerable expense and trouble to issue this bulletin, they are delighted to know that it is so serviceable and is so highly appreciated.

One of the humorous incidents of the convention was the mysterious appearance and wide circulation of a pamphlet in cover of sanguine hue, and full of funny cuts and quaint phraseology, intended as a skit on the famous Edison "red book." The pamphlet in question was eagerly sought after, and its sly sarcasms seemed to be enjoyed by the Edison men who got it, not less than by the others, into whose hands it fell.

Goulds & Austin represented the New York Belting and Packing Company at the Convention. Their exhibit, in charge of Mr. R. W. Caldwell, Jr., was greatly admired.

The Pond Engineering Company, of St. Louis, made an interesting exhibit of its system of steam plants for driving dynamos in central and power stations.

The Edison phonograph & Tainter-Bell graphophone exhibit created marked curiosity in the many thousands of visitors who thronged the building.

Both instruments were in operation, and their most practical use, thus far, in dictating to a typewriter, was shown by letters written on a typewriter on the spot. The enunciation of every syllable was distinct, and even an unpracticed ear could easily understand all that was said. This exhibit was in charge of Gen. G. B. Raum and several assistants, whose patience and endurance must have been sorely tried by the press of the crowd that went to see "Edison's phonograph."

Mr. E. B. McClees had charge of the neat "Kerite" exhibit of wire and tape. "Kerite" is a name that is sufficient in itself, and the goods require no further description at our hands.

The Weston Electrical Instrument Company exhibited a number of the new Weston voltmeters and ammeters, descriptions and illustrations of which appeared recently in THE ELECTRICAL WORLD.

Mr. A. Conkling had charge of the "Giles Anti-magnetic Shield" exhibit, and his show case was full of beautiful watches magnetically protected. Mr. Conkling was kept busy answering inquiries as to his method of protecting watches by the Giles' shield, and in quoting prices.

The National Carbon Company, of Cleveland, O., exhibited their various sizes of arc light carbons, both plain and cored. The exhibit was in charge of Messrs. W. H. Lamereux and W. C. Hayes.

The Waltham Watch Company exhibited their non-magnetic watches, and the influence of magnetism on one watch with a steel and one with their non magnetic spring, respectively. This was illustrated by means of an apparatus which alternately brought the two watches in a strong magnetic field. The ordinary watch was stopped entirely, while the non-magnetic continued unaffected. Another interesting device shown was a large chronograph adapted for horse timing. It is intended for race tracks, and shows the time, which is registerd electrically, to all the spectators, so that no disputes can occur. The one exhibited is to be used permanently in Chicago.

Ever genial and affable J. H. Shay was in charge of the "Munson" belt exhibit, and when he could not be found at his post it was safe to assume he was taking an order for his goods in some other part of the building. The belts shown were of the following sizes: 60-inch, 28-inch, 18-inch and smaller belts. All of the belts used in driving the machinery in the large hall were supplied by the Munson Company.

The Okonite Company, of New York, had a very tastefully arranged exhibit of their different products in the space of their western agents, the Central Electric Company of Chicago. Among these we noted the well knowr Candee aërial wire, Okonite wire in all sizes, Okonite and Manson tape, etc. The exhibit was in charge of Capt. W. L. Candee and Mr. G. T. Manson, and not its least attraction was the darky attendant who bore the well known "Okonite" emblem on his immaculate shirt front.

The Central Electric Company, of Chicago, showed a varied exhibit of Okonite wire and tape, for which they are the Western agents, and also the various products in hard rubber of the Butler Hard Rubber Company, of New York. The exhibit also contained a large line of electric tools for inside wiring and overhead line work. On the first day the company presented all visitors and friends with handsome boutonnières.

The Paillard Non-magnetic Watch Company exhibited their well-known watches with palladium alloy springs. The exhibit was in charge of R. S. Hubbell and C. R. Botsford. Neat little celluloid note-boks were distributed by the company as a souvenir.

A most novel and strikingly beautiful display was that of the Phœnix Glass Company, setting ablaze with all the tints of the prism a large portion of Department B. Mr. E. H. Fox was in charge, and with his attentive assistants was extremely courteous to the crowd that could not help but be attracted by such an exquisite display. Glass globes and "stalactites" of every line and shape were lit up by incandescent lamps, and the shelves of the entire end of the room groaned under their weight of artistic glassware.

Cook & Canny's exhibit of their underground conduits was a prominent feature in Department B; samples of conduits were shown with wires in them. Two separate systems were shown, one for running bare wire underground, and the other for insulated wire.

Mr. Wm. B Cleveland, of Cleveland, O., exhibited his well known switches and cut-outs.

The Automatic Switch Company, of Baltimore showed their new switch for cutting motors in and out of circuit so as to avoid all danger from overheating and burn-outs. This switch was recently illustrated and described in THE ELECTRICAL WORLD.

The Chicago Rawhide Manufacturing Company exhibited a great variety of their belts, including light dynamo belts, single and double, rope and twist belting, and lace leather. The exhibit was in charge of W. H. Preble, who showed us a piece of hard rawhide used for friction and gear wheels. This, he said, would wear better than steel on electric cars.

The exhibit of Clark wire, made by the Eastern Electric Cable Company, was in charge of Mr. H. H. Eustis, and contained a large variety of wire of that well-known make.

The Russell Electric Manufacturing Company had on exhibition two of their mast arms, which have already been described in our columns, and the operation of which was shown by Mr. Charles W. Rucsell. The ease with which the lamp can be manipulated was greatly admired. Mr. Russell also exhibited a number of drawings.

Holmes, Booth & Haydens made a handsome exhibit of bare and insulated copper wire.

The Aston Valve Company, of Boston, showed a large line of their pop safety-valves. The exhibit was in charge of Mr. A. J. Hewlings.

The Chicago Feed-Water Heater and Purifier Company exhibited their apparatus for the purification of water for boilers.

The Detroit Lubricator Company showed samples of their lubricating oils, and had charge also of the exhibit of the Edson pressure recording gauge.

The Hill Clutch Works, of Cleveland, O., exhibited a large variety of their well-known clutches, ranging from the smallest to one over six feet in diameter, and capable of transmitting several hundred horse-power. Quite a number of the clutches were labeled with the name of the factories and plants for which they had been built, and a number of them were shown in operation. Many favorable comments were made on a beautiful piece of shafting nearly 20 feet long and 6 inches in diameter, with key ways milled and ready to be set up in line. The exhibit was in charge of Mr. C. A. Burns, and Mr. H. W. Hill was also on the ground to give information on his method of power equipment for central stations.

The Tuerk Water Motor was shown operating a "Junior" dynamo, and making a very compact plant for domestic lighting. There was also shown in this exhibit the "Sun" incandescent burner. Both exhibits were in charge of Mr. F. G. Kune.

The Eureka Belt Company's exhibit, in charge of Messrs. C. A. Landy and R. H. Salter, contained various sizes and thicknesses of cotton belting specially designed for dynamo driving.

Parrish Bro's. & Peck exhibited the Detroit storage battery. The generator employed in charging the cells was a Thomson-Houston motor run as a dynamo. In Department "A" the same firm exhibited their bell signal alarm apparatus for railroad trains which was operated by one cell of storage battery.

The John A. Roebling's Sons' & Company, exhibited a variety of copper wire, both bare and insulated, and their various steel cables. Great interest was taken in a section of one of the Brooklyn Bridge cables which was on exhibition in their stand.

The Stilwell & Bierce Mfg. Company exhibited their horizontal Victor turbine, which is in use in a large number of electric light stations; also their live steam purifier. The exhibit was in charge of Mr. Brooks.

The Belding Electric Motor Company, of Chicago, exhibited a number of their motors, beautifully finished, and ranging in size from ⅛ to 7 h. p.

The Bliss Shafting & Pulley Company, of Chicago, exhibited the friction clutches of the Falls Rivet Company,

The H. W. Johns Manufacturing Company, represented by Mr. R. J. Coleman and E. B. Hatch, exhibited a large variety of their products in asbestos from the crude material to asbestos packing and covering for steam boilers and pipes. Ther were shown, too, asbestos insulating paints. A prominent part of the exhibit were the samples of insulating pipe for carrying water underground. This pipe is made in short sections of pressed wood pulp and asphalt with the ends screw threaded. The sections are joined together by collars which cover the joints completely. There were also shown branch connections for leading out wires at any point for local distribution. Another interesting part of the exhibit consisted of pressed, moulded fire and water-proof ends for commutators. The vulcabeston insulation, consisting of asbestos and rubber, in sheets, was also shown.

The Standard Underground Cable Company, whose exhibit was in charge of Mr. E. G. Acheson, contained a variety of the well-known products of this company, and as the subject of underground wires is now so live a one, the exhibit naturally attracted a large number of visitors.

Messrs. E. B. Preston & Co. exhibited a fine lot of their special dynamo belts in all sizes, and the attendant was kept busy answering inquiries regarding them.

Messrs. Locke Bros. exhibited the Locke damper regulator, and the one on exhibition was critically examined by the many central station managers present.

The Queen City Electric Company, of Cincinnati, had a neat exhibit of their small motors and fan outfits.

The Ball Electric Company, represented by Messrs. Raymond and Stockwell, exhibited an eight arc machine driven by a 15 h. p. Thomson motor. The machine was said to be delivering 3 arc lights to the horse-power.

Mr. H. C. Higgins had charge of the exhibit in which was employed the St. John self-adjusting cylinder packing. This is an expansion metallic ring which is self-adjusting, being expanded by the pressure of the steam.

The Reliance Gauge Company, of Cleveland, O., had on exhibtion a fine and complete set of their steam pressure gauges, etc.

The Simplex Electric Company, represented by the genial Mr. A. F. Mason, in addition to their regular product, the "Simplex" wire, showed an insulating staple designed for electric wiring of all kinds. The trouble frequently experienced with metal staples made this insulating staple, which is as hard as steel, the subject of many inquiries, and it was very favorably commented on by all who examined it.

The Shultz Belting Company, of St. Louis, made a specialty of exhibiting their leather-covered pulleys for dynamos. These pulleys run noiselessly and obviate the slipping of belts entirely.

The "Callender Wire" was ably represented by Mr. A. C. Shaw, of the Callender Company. Mr. Shaw not only had a full line of samples of "Trinidad," "Bitite" and other wire, but also samples of wires in conduits, showing actual sections of same. He also showed samples of McIntire's electric wire connections, for which his company are now agents.

Charles A. Schieren & Co. exhibited samples of leather link and perforated belts, the last named having recently been brought prominently to the attention of electric light station managers. The American Leather Link Belt Company showed a similar class of goods on the same floor space. A number of machines in the building were run by Schieren belts.

An Eddy electric motor of 10 h. p., incandescent, was in charge of Col. M. E. Baird in Department A, and attracted considerable attention in consequence of its small size in proportion to the power developed.

The C. & C. Electric Motor Company ran three sewing machines doing actual work on cloaks, etc. They also showed a number of fan outfits and motors, besides a peculiar device for use in clothing establishments, which we will describe. A 2 h. p. C. & C. arc motor ran a ½ h. p. machine as a dynamo; the current from this little dynamo passed through the ½ h. p. motor of an electric cloth cutter, making a most ingenious and useful self-contained electric cutter which cannot fail to interest those using such machines. Mr. H. L. Lufkin was in charge of the exhibit.

James W. Queen & Co.'s exhibit was one that was much appreciated by all of those conversant with electrical testing instruments, and was one of the most complete we have ever seen. Mr. R. O. Heinrich, who was in charge, especially called our attention to Sir Wm. Thomson's new standard ampère balance, which, he said, was exhibited for the first time in this country at this convention. Besides the testing instruments of high precision, adjusted by Prof. Anthony, we noticed a direct reading ohm-meter designed by their electrician, which seemed to very portable. Another box contained a galvanometer, battery, rheostat and slide wire bridge in a space of 10″ × 10″ × 6.″ A large photometer was also shown.

The Electrical Supply Company, of 171 Randolph street, Chicago, made an exhibit in Department A that was more like a complete supply depot in itself than a display of a few samples. Everything that could properly come under the head of "supplies" was shown in the greatest variety. A few items noticed were electric light tools, lamps, pendants, shades, speed indicators, switches, push buttons, soldering outfits, wire of all sizes and description; insulators and testing instruments, and many other devices used in and about central stations and in house wiring and electrical work.

The Sperry Electric Company had for their exhibit a fully equipped central station in department A, which was in charge of D. P. Perry, vice-president and general manager. The apparatus in operation consisted of two 10-light arc machines, one high tension and the other low, of the improved Sperry type. One of these machines generated a current of 10 ampères under a pressure of 450 volts, and the other 19 ampères under 300 volts. Besides these machines in operation there was one 20-lighter taken apart for the purpose of showing how advantage is taken of the winding on the interior layers on the armature, by which 92 per cent. of the wire on the armature is advantageously used; this requires the use of only forty pounds of wire on a 25 light dynamo. Mr. Fred. Deland, of the Sperry Company, distinguished himself at this convention in a marked manner by many thoughtful courtesies to those seeking information. As to the regulation of the improved Sperry dynamo Mr. Deland assured us that it is possible to cut off from full capacity to one light, and *vice versa*, with no apparent effect on the circuit. Much attention was drawn to the new electric coal drill, of Mr. Sperry's design, on exhibition in department A. This drill delivered its full blow without recoil and with any length of stroke.

The well-known Bernstein series incandescent lamps and cut-outs were shown in Department A, under the supervision of Mr. H. B. Cram.

The Kester Electric Motor Company exhibited a beautiful 4 h. p. constant potential motor, with rheostat on top of the same. Its speed was 1,200 revolutions per minute. Mr. J. F. Kester was in charge. The motor shown was of the 4-pole type and of 110 volts, and ran with remarkable smoothness and without sparking.

Mr. Fred. H. Whipple, well known through his work on "Municipal Lighting," occupied a desk in Department A.

The American Electrical Works, of Providence, R. I., were represented by Mr. P. C. Ackerman. Magnet and annunciator wires, both cotton and silk-covered, and incandescent light flexible cord were shown in great variety; a large coil of the well-known "Black waterproof wire" was also on hand. Mr. Ackerman showed us a small reel of silk-insulated magnet wire, No. 40, containing one pound of wire, which was valued at $20. This wire is, of course, used in the finest testing instruments only.

The Western Electric Company, although making no special exhibit in the Exposition building, were ably represented by Col. Geo. Beetle, who insisted that their immense factory in Chicago, open to the visitors at the convention, was the best possible kind of exhibit.

The Thomson-Houston Electric Company were centrally located in Department A, where they made a most comprehensive exhibit of almost everything in the electric light line. Among the apparatus shown were arc and incandescent lamps, motors, a switch-board for arc lighting stations, large cut-outs for motors, to say nothing of the Thomson-Houston apparatus used in various parts of the exposition building in connection with other exhibitors. In the outer hall a fully equipped Thomson-Houston electric car was in daily operation, and a visit to the convention was incomplete without a ride on this car. Everything went off smoothly, and the visitors had ample opportunity to compare the merits of an electric car with those of the cable system in Chicago and other cities.

The Excelsior Electric Company were located in the central floor space of Department A. The exhibit consisted of the Excelsior arc and incandescent dynamos in operation, together with a very smooth running Excelsior motor, whose field regulations and governor contact device was greatly admired by the electrical experts present. Mr. F. W. Horne was in charge.

The Washburn and Moen Manufacturing Company had on exhibition a handsome show case containing samples of their well-known cables, and different styles of hard and soft-drawn copper wires.

Those in search of Mr. J. W. Godfrey found him adjacent to the "Gleason" exhibit, where he expounded the merits of "Grimshaw" wire and tape, and otherwise did credit to the interests of the New York Insulated Wire Company. As usual he had on hand a full line of samples, and was ever ready to answer questions and give information as to the orders he has recently taken, the buildings recently wired, and the tests to which his "white core" has been subjected.

The E. P. Gleason Manufacturing Company occupied the large southwest room of Department A, where the eye was delighted by a most magnificent display of electroliers, globes and shades for electric lights in a great variety of exquisite tint and form. W. F. Cullen was in charge, assisted by a number of associates from New York, among them Mr. E. F. Gennert. Among the endless assortment of samples in their line, we noticed a number of advertising sign globes, one of which bearing the legend of "Wines and Liquors" was suggestively near the wire exhibit in the next room.

The Schenck Belt Holder and Shifter Company, represented by the inventer Mr. Unico H. W. Schenck, of New York, having run out of 2,000 descriptive catalogues the first day of the convention, left a notice for those wishing same to drop their name and address in a box provided for the purpose. The accumulation of 1,500 of these inquiries in one day shows the interest taken in the working model on view in Department A.

One of the most prominent exhibits was that by the George F. Card Mfg. Company of their various motors and dynamos in actual operation. A large space was allotted to this exhibit, among the prominent features of which were a Thomson-Houston motor running a 60-light incandescent Card dynamo of 110 volts, and a 2 h.p. Card motor running one of their incandescent 25-light dynamos. A number of other motors were on exhibition, among which we noticed a 5 h. p. arc motor with the Card automatic regulator. This fine display was in charge of Capt. F. McClure, assisted by Mr. E. B. Richart.

An entirely novel innovation, and one evidently appreciated by the wire men, was an exhibi ion of insulating silk and cotton by the well known house of Hugo Meyer & Co., New York. Mr. Fred. Moss, who was in charge of this exhibit, was located next to the Callender wire exhibit, and did due credit to the occasion in answering inquiries regarding his interesting display.

The Pumpelly storage battery, in regard to which our readers are already posted, was represented by Messrs. H. G. Osburn and L. W. Lamoree. Their tiers of storage cells were charged from a small Bain dynamo which was belted to a 5-h. p. 220-volt Thomson-Houston motor. These batteries were furnishing lights in and about this exhibit, and those who are already familiar with the details of its construction had a fine opportunity of witnessing many interesting and practical tests.

The Shields & Brown Company, of Chicago, displayed a line of their insulated sectional steam pipe and boiler coverings. This exhibit was in charge of H. A. Reeves.

The National Automatic Fire Alarm apparatus was located in department B, and was shown in actual operation. It was operated by eight cells of gravity battery and four of Diamond carbon. An increase in temperature, due to fire or other causes, automatically turns in an alarm, and the apparatus on exhibition could be so delicately adjusted as to be set off by a mere breath from the lips. Mr. G. V. B. Frost was in charge.

The Waters-Sweeny Telegraph and Telephone Switch Company, of Terre Haute, Ind., made an exhibit of their telegraph and telephone switches. Mr. R. G. Sweeny was in charge.

A large portion of the outer hall was devoted to the exhibit of the Johnstone underground system. A section of conduit, containing wires as they are actually laid in practice, was shown in a way that left little to be explained. This exhibit was not only interesting to the thousands of visitors who poured through the building, but also to the members of the association and all other electrical people present, on account of the intense interest shown in the action of the association on the commercial feasibility of underground systems in general. Mr. Johnstone himself was in charge of the exhibit, and kept open house in his handsome suite of rooms at the "Richelieu," where he was prepared to answer satisfactorily, he said, any questions regarding his system.

The Eclipse Wind Engine Company, of Beloit, Wis., made a very practical exhibit of their own shafting, clutches and pedestals, which were used in running the dynamos in the outer hall. Their main line of shafting was belted to the 100 h. p. Rice engine, and those who wished to investigate the peculiarities of this clutch had ample opportunity of doing so.

The John T. Noye Mfg. Company, builders of the "Rice" automatic steam engine, showed one of their 100 h. p. automatic engines running two Thomson-Houston machines. The engine was making 230 revolutions per minute and did the work easily and smoothly.

Fairbanks, Morse & Co., of Chicago, had a large Williams engine of 90 h. p. on exhibition in the large outer hall.

The Buckeye Engine Company showed a 125 h. p. Buckeye engine running two Thomson-Houston machines and also two 20-light Excelsior dynamos. This engine was running almost noiselessly, although it ran at the rate of 230 revolutions per minute. Mr. M. W. Robinson, agent for Chicago, was on hand to furnish any information desired.

Mr. A. C. Kemper, of Chicago, called our attention to his Magnesia sectional covering, used in connection with the Rice engine. Mr. Kemper stated that the radiation from the covering shown on this occasion was only 13.87 kil. cent. heat units under 85 lbs. pressure.

The Miller Heater & Purifier Company showed their apparatus in operation on the floor of the main hall.

The New York Safety Steam Power Company showed one of their special vertical electric light engines in addition to their 80 h. p. automatic engine, the latter of which was running quietly the various dynamos in the exhibit of the National Electric Manufacturing Company; the engine was running at 300 revolutions. In this engine the Mosher metallic packing is used.

The National Electric Manufacturing Company, of Eau Claire, Wis., made a fine exhibit of their dynamos, direct and alternating, and motors, in the outer hall. One of their generators furnished current for several Thomson-Houston, Queen City and Eddy motors, supplying as well that used by that used by the Pumpelly storage battery. Mr. W. K. Freeman was in charge.

The Ide Engine Company showed one of their large engines in the outer hall.

A very neat exhibit was given of the Fletcher (Dayton) adjustable hanger for arc lamps, by the Electrical Supply Company. Mr. Fletcher, as an old electric light man, knows just what is wanted, and has provided it—as the display convinced everybody.

The Tamarack Osceola Copper Manufacturing Company, of Dollar Bay, Mich., made a fine exhibit of their pure lake copper wire. Mr. S. Rosenstamm represented the company, and, it is understood, took several large orders for wire.

Mr. T. H. Brady, representing the "Brady Mast Arm" of New Britain, Conn., was on hand, and not only was available at all time for information, concerning his apparatus, but took an active parts in the proceedings of the convention.

The Paiste incandescent electric switches were shown in department A in connection with the exhibit of the Fletcher gem wire holders and sleet-proof pulleys, making an interesting display for those interested in incandescent lighting.

The Western Wheeler Reflector Company, of Chicago, made a tasteful display of their various patterns of electric light reflectors.

The Detroit Motor Company located their exhibit in Department A, and showed a large number of motors connected with sewing machines, fan outfits and dental apparatus. These motors are made in sizes varying from 1-20 h. p. to 5 h. p. Mr. A. A. Robinson was in charge.

The U. S. Grate Bar Company, of Chicago, showed one of their self-cleaning grate bars. Among the users of the 10,000 now in operation, is the Rock Island R. R. Company, which uses them exclusively. Messrs. R. C. Rose and John Moroney were in charge

One of the features of the exhibit in the outer hall was a number of Worthington Steam pumps and water meters. The details of these pumps are well known to our readers and will require no further description here.

The Fort Wayne Jenney Electric Company's exhibit was fully twenty feet from the floor, in full view of all visitors entering the outer hall, and read as follows: "This space in the air reserved for the Fort Wayne Jenney Electric Company. Owing to the recent fire and to the fact that we have now on hand orders aggregating $14,000,000, we are compelled to forego the exhibit of apparatus expected of us by our friends. We have plenty of nerve, but no machinery to spare, – hence this display of our only available merchandise. We will be pleased to see our friends at 185 Dearborn street.

W. J. BUCKLEY,
"Manager Chicago Office."

Municipal Lighting.

BY ALEX. P. WRIGHT.

There appears to be to-day a tendency towards municipalities owning and operating their own electric light plants. The wisdom of this is, in the majority of cases, doubtful. The causes which have led to such an issue are not without remedy, and a remedy which will naturally follow any very large amount of work in this direction. That this is so is, in a measure, due to the high rates charged by electric light companies, which are certain, in the face of municipal competition, to be reduced. Besides the loss of business to the electric light companies, there would be many other disadvantages, not the least of which would be the difficulty of getting lines through the streets for general lighting, which heretofore the street lighting has enabled them to do. That municipalities can operate their own lighting systems as economically as electric light corporations is not disputed, but that the average of them will do so may be. In the first place, the greater number of such plants would be influenced by politics in the choice of their superintendent and employés, and it is fair to presume that in very few cases could either superintendent or qualified men be found among the class of "office seekers." The supply of fuel, one of the principal elements of economy in a lighting station, would be a temptation, even in a small plan, to jobbery, or subject to political influence, and even were a corporation free from this, it could not produce electric light at as low a rate as a well designed and managed light company, because it would be producing at retail what the electric light company would produce at wholesale; the total cost per lamp for apparatus and installation being necessarily higher than in a larger plant, as also the cost for labor, which latter would frequently amount to as much as in stations of larger capacity. The natural tendency will be for electric lighting companies, when they begin to realize that municipalities contemplate owning and operating electric plants, to come down in their prices, which they could well afford to do in many cases in return for the privileges granted them, provided they were granted contracts for a long term, rather than lose the business. Taking into consideration the concessions made by corporations to them, they would charge rates sufficient to cover cost of operation and depreciation with a small interest on investment, or even at cost, as a means of enabling them to operate the remainder of their plant at a lower rate. The only conditions under which a corporation can afford to own and operate their own plant would be where politics were absent and where the amount of lighting was fairly extensive, and where, perhaps, they could put the poles erected by them to do the full work of which they were capable, by renting to electric light, telephone and other electric companies fastenings for their wires. Otherwise the cities and towns operating their own plants would be increasing the number of poles, and consequently the unsightliness of their streets, of which they, as a rule, so bitterly complain. If a good line of 60 to 80 foot poles were erected on either side of the streets capable of carrying present and future wires of all kinds, charging for fastenings at a reasonable rate, sufficient to pay fair interest on cost, in the majority of cases far more good would be done for the citizens by the investment of the money which would otherwise go to erecting an electric lighting plant, and with benefit to the electric companies. A reduction in the number of poles in a given distance in many cases would follow, and great uniformity and neatness might be obtained if the poles were well chosen, of timber, or neatly designed if of iron, which would render the overhead wiring, of which so many complain, scarcely objectionable; and when the electric street railway arrives, as, no doubt, it must eventually do, and will, no matter what the opposition, the streets need not be further encumbered with poles, if the city lines are arranged with a view to supporting the electric railroad wires.

There is but little doubt that investment in this direction by a municipality would be more satisfactory to its citizens and would result in a lower rate for street lighting when a balance were struck at the end of the year. Fairly and properly constructed lines, with fastenings charged for at moderate rates, would result in a lower cost to electric companies, in that the one set of poles would be doing the work for which each of them under the old order make separate expenditures.

The Hamilton Plan for Utilizing Niagara.

BY H. F. WATTS.

The issue of THE ELECTRICAL WORLD, Feb. 9, 1889, contains a very interesting account of the effort being made to utilize Niagara Falls on a commercial scale for electric light and manufacturing purposes. The scheme proposed, and which will, I hope, shortly be put in practical operation by Mr. Hamilton, would seem to be the best that can be devised for this purpose, and it would also appear that to him is due the $100,000 prize offered for the solution of the problem. It is, however, the electrical points that I wish to call to the attention of your readers.

In the *Western Electrician* of August 25, 1888, I made the statements that "the successful electrical transmission

of the power of Niagara Falls to New York and other cities *will be solved by the alternating system* if solved at all." The alternating system would seem to possess many points in its favor, which render it most eminently suitable for the transmission of power on such a scale.

The alternating system has already solved one of the greatest engineering problems of this age—the transmission of electric energy over great distances to fulfill commercial requirements with safety and economy. The question is, therefore, asked: Why not use the alternating system and arrange the apparatus something like the following? Take a Westinghouse 3,000-light dynamo just as it is, giving 1,050 volts and 150 ampères. By means of a special converter raise the potential to 5,000 volts and reduce the current to 30 ampères. This, transmitted over 22 miles of No. 3 B. & S. gauge, gives a loss of about 12 per cent., or a No. 0 would, for 44 miles, give about the same loss. The loss in the converters would be less than 5 per cent. each at full load. Another converter at the other end of the circuit reduces the potential to 1,000 volts or any other desirable pressure for the motors. Three wires will be required and hence the above figures will be modified. The motors will be of high efficiency, will run at a constant speed without brushes or commutators and with a minimum of attention. With 5,000 volts initial pressure, the efficiency can be 70 per cent., notwithstanding the losses in the various conversions. Here is a chance for the alternating system to show its superiority.

In the article in question (Feb. 9) no mention was made of the proposed construction of the line. The following would seem to best fit the requirements. Let poles be erected not over 50 feet apart; of large size, 20 feet high, and not less than 15 inches in diameter at the ground level. These poles to be set in the earth not less than 8 feet and secured by cement and broken stone. The poles to be "filled" with paraffine and also the short stout cross-arms at the top, and the wooden pins that hold them. The base of the poles should be preserved from decay by the use of vitriol, etc. The wire is supported by a large round glass insulator through which the wire slides freely, the glass slide being supported from the under side of the cross-arm by a special insulator of large size and of the "rubber-hook" type. The "hook" insulator might also be further protected by a small hood placed above it. Such a line would possess very high insulation, even in wet weather. It could be easily and cheaply constructed, and could be maintained intact in the most violent gales, even when covered with ice.

Relation of Candle-Power and Current in Incandescent Lamps.

In the *Centralblatt fur Elektrotechnik* Herr K. F. Slotte publishes a series of investigations to show that the candle-power of a glow lamp varies directly as the fourth power of the excess of current over that at which the lamp first begins to emit visible rays; that is,

$$l = k\,(c - c_0)^4,$$

where k is a constant differing for every lamp, l the candle-power at current c, and c_0 the current at which visible rays first begin.

The following (shortened) table shows the results obtained with an 8 candle-power Edison lamp:

EDISON LAMP, 8 CANDLE-POWER. $k^{4th} = 2.707$ $c0 = .29$.

c.	l^{th}. Calculated.	l. Observed.
.525	.64	.68
.610	.87	.87
.732	1.20	1.20
.842	1.49	1.48
—	—	1.68 = 8 c. p. (normal)
.990	1.89	1.91
1.23	2.54	2.54
1.29	2.71	2.66
1.32	2.79	2.66 = 60.1 c. p.

Similar close agreement between the observed and calculated columns obtains also in the case of two Bernstein lamps, two Siemens, a Woodhouse and Rawson, and a Cruto. It will be noticed that the observed candle-power drops a little behind the calculated when the lamp is very much overrun. This occurs also in a 20 candle-power Bernstein, for which the author gives observations up to 480 candle-power, at which the lamp broke down, but up to 280 candle-power the agreement shown between the theory and experience is almost absolute.

The Rose Polytechnic Institute.

The Rose Polytechnic Institute, an advertisement of which appears in our columns, this week, is one of three or four schools in the United States which are especially devoted to the education of civil, mechanical and electrical engineers. It owes its existence to the generosity of the late Chauncey Rose, of Terre Haute, Ind., who bequeathed something more than a half million of dollars for its establishment and support. It is one of the youngest of the technological schools in the country, having been opened in the year 1883.

One of the peculiar features of the institute is the thorough and extensive "shop practice" of the students in mechanical engineering. Not only are machines designed and working drawings made, but actual construction is required and is made possible in extensive workshops, the equipment of which has cost over forty thousand dollars.

In electricity, in addition to the instruments and appliances usually found in electrical laboratories, it possesses the most complete and accurately adjusted series of Sir Wm. Thomson's electrical balances in this country, and there is a completely equipped testing room for the purpose of calibrating and standardizing commercial instruments.

Another important feature is the restriction placed upon the number of students admitted. The plan of the institute is to limit the attendance to such an extent as to realize the great benefits arising from small classes.

Ample facilities will therefore be afforded to all who undertake its courses of study. Those who are contemplating preparation for either mechanical, civil or electrical engineering, will do well to consult the catalogue of the Rose Polytechnic Institute.

Mining Engineers in Convention.

The annual convention of the American Institute of Mining Engineers was opened on Tuesday evening, the 19th, at Hardman Hall, this city. On Wednesday the visitors, to the number of 250, made an excursion to the Spiral Weld Tube Works, of which Mr. Bayles is president, near Newark, and passed some time in examining the new process of manufacturing tubes. They then took the train to Llewellyn, and were received at the Edison Laboratory by Mr. Edison, who showed them through every department of the laboratory and explained the nature of the work that had been done. Luncheon was then served, and was followed by a paper prepared by Mr. John Birkinbine, of Philadelphia, with Mr. Edison, on the "Magnetic Concentration of Iron Ores." Nelson W. Perry, of Cincinnati, also read a paper on "The Brush Plant at Virginia City, Nev.," and P. G. Salom, of Philadelphia, read a paper on the "Julien Accumulator." Mr. Salom had intended to extend his remarks to the use of storage batteries in mining, but time would not permit of his doing so.

At 8 o'clock the Mining Engineers were again in session at Hardman Hall. Some very interesting papers were read, including one by R. A. Cook, on "The Wenström Magnetic Separator," and one by William Glenn, on "Notes on the Electrolytic Assay of Copper."

On Thursday the engineers visited the Consolidated Gas Company's Works, Fourteenth street and Avenue C, east side, and inspected the machine stoker for discharging retorts, also the large steel water tank and triple section telescopic gas holder. The tank holds 35,000 tons of water, and the gas holder contains, when filled, 3½ million feet.

On Friday a session was held at Stevens Institute, Hoboken, N. J., and the rest of the day was occupied in excursions to various points of interest.

At the closing session at Hardman Hall there was an animated discussion on the matter of pleasure trips. A member of the Institute thought that too much time had been given this year to pleasure and not enough to business. Secretary Raymond, who arranged the very successful programme of the convention, took vigorous exception, and the views of the respective members were exchanged with such earnestness that the president had to call them to order. In the evening the members dined at the Brunswick Hotel. On Saturday some of them went to inspect the electrical plant and Capt. King's big magnet-guns at Willet's Point.

Proportion of Battery to Line.

To the Editor of The Electrical World:

Sir: Will you please inform me what rule is observed in proportioning battery to telegraph lines. I have read that one cell of No. 2 battery for every 40 ohms was needed.

New Haven, Conn. N. E. S.

[Answer.—The rule is to apply 1 volt to every 40 ohms resistance, but telegraphers do not follow this absolutely. A good plan is to put on enough cells to get .03 ampère for 150 ohms of relay. This will give satisfactory results.—Eds. E. W.]

The Training of Electrical Engineers.

To the Editor of The Electrical World:

Sir: I am now about the middle of my second year's subscription to The Electrical World and find electrical matters of so interesting a nature, that I almost *crave* for the electrical brain-food contained in its columns. I notice numerous correspondence and answers, which in many cases are very instructive, and in two or three instances have furnished me information, of which I was in doubt.

In your issue of Feb. 2, Mr. Alex. P. Wright, under heading "Economy of Central Station Construction," confirms "A Shareholder's" communication in issue of Jan. 26. In my experience of over six years in electric lighting, I have seen much trouble in the members of a company not placing enough confidence in the ability of their manager, superintendent and wiremen. Why is it that such should be the case? There are too many *amateurs* in the field professing, in their ignorance, to know more than they do, and many through influence are kept in positions to do work, even at the present age of electrical science, of a *very* inferior nature. Why should not every person, wishing to follow the electrical profession, be thoroughly examined each year, and receive a certificate classifying him for a certain field? In that way any person making application for positions would only be required to send the *grade* of his certificate, or in advertising, state grade of work for which assistance is wanted. There are so many branches in electrical applications, that in advertising for an *electrician*, etc., you cannot tell what will be expected of a man.

Indianapolis, Ind. W. North Robins.

Obtaining Light Without Heat

To the Editor of The Electrical World:

Sir: I have read the editorials and communications that have recently appeared in The Electrical World under the above caption with great interest, but I did not yield to the temptation to address you upon the subject until I found, in the issue of Jan. 26, an article from Mr. A. B. Worth, wherein that gentleman states his claim to the invention of such a light, and expresses the desire to be "placed on record." It now, therefore, behooves me to fall in line and emulate Mr. Worth's laudable desire.

My first experiments in the production of light without heat were made in Portland, Ore., during the winter of 1882-3. At the time a fair degree of success was attained in a small way, but the experiments were discontinued because of change of residence, and an unfortunate and almost disastrous wrestle with the bread without butter problem. During the last eight months of my residence in San Diego, however, I have devoted a great deal of time each day to the perfection of the old idea, and have succeeded in obtaining a light that is very brilliant, most pleasing to the eye, and one that is remarkably penetrating. Moreover, the lamp remains absolutely cold during the production of the light, and so far as I am able to discern, its temperature is the same whether it is lighted or not. The remarkable economy of my light is also worthy of record. With a single cell of battery generating only enough current to heat the filament of a 1 c. p. miniature Edison lamp to the dullest red, I have been able to obtain a light by means of my lamp and system that lighted a room 12 feet square sufficiently to enable one to discern the time by a watch held not less than two feet from the eyes, when the lamp was placed in one corner of the room and the observer stood in the diagonal corner. The operation of the light has been witnessed by several reputable citizens of San Diego, who can attest the truth of these statements. Geo. P. Low.

San Diego, Cal., Feb. 7, 1889.

The Problem of Light Without Heat.

To the Editor of The Electrical World:

Sir: Several communications lately appearing in The Electrical World from Mr. A. B. Worth, of Greenport, L. I., on one of the great scientific problems of the day, "Light without Heat," have excited no little interest and curiosity. Now if Mr. Worth is on the road to practical success in unraveling the difficulties of the subject, as he most strongly claims to be, congratulations should be showered upon him without stint. But if Mr. Worth would but wait until he was prepared to furnish some material proof of this success of his work; and did not dilate upon the existence of his half-hatched substantiations, but remained silent till the incubative period was fully past—how much more sure the congratulations would be of falling in the right place!

When it is learned from an authority, who should be conversant with the facts, that Mr. Worth, besides having several ways of producing light without heat, and electricity without dynamos—has "work on an equally large scale in other departments of science"—has invented several talking machines (one of which he intends to bring out sooner or later), and that the pyro-magnetic moter idea was a tenant of his brain for a short time, it remains a matter of wonder that Mr. Worth has not posed also as the first and original inventor of the telephone, and that no claim has been made in his behalf in regard to the invention of the electric sugar refining process and the Keely motor. Perhaps Mr. Worth's excessive modesty explains the non-mention of these trifles. G. T. Evans.

Schenectady, N. Y.

New York Board of Electrical Control.

A meeting of the Board was held at the Mayor's office on Monday, the 18th ult. The Mayor, after stating that hitherto the issuing of permits had been done by the secretary, proposed, and it was resolved, that no permits be granted in future except in open meeting of the Board.

Further evidence of the intention of the Mayor to grapple with this subject with the most uncompromising vigor was afforded in his next motion, by the adoption of which all permits granted by the Board upon which the work had not been finished up to that day were revoked.

The Mayor said he was opposed to granting any more permits for poles and wires in streets where there are no subways. In other cases he proposed to give permits only when absolutely necessary. He also objected to allowing permits for trunk lines of telegraph under any circumstances.

Commissioner Gibbens confirmed what he termed the "admirable policy" that the Mayor has inaugurated since he assumed the presidency of the Board, and mentioned incidentally that the condition of things since that time had entirely changed. The Board had previously been handicapped by want of co-operation at the hands of those on whom the work of getting the wires underground devolved, but now it had the local help that was necessary, and it will relax no effort to expedite the accomplishment of the task it has in hand. There was actually nothing in the resolutions of the Mayor that reflected in any way on the Board, as whatever its wishes might have been in the past it had been to pursue a certain policy, which has now become quite unnecessary.

The Mayor said he did not make any of these resolutions with the idea of reflecting in any way on the past actions of the Board. On motion of the Mayor the numerous applications presented to the Board were laid over for a report of the expert and engineer on the nature and conditions of each application, with the injunction that the expert would have to be assured on the most satisfac tory grounds that any application was entitled to the consideration of the Board, before it could be presented.

The Mayor then asked Dr. Wheeler, the electrical expert, why the United States Illuminating Company had been allowed so much time in making their test.

Dr. Wheeler said he did not understand when he was instructed to confer with the company with a view to getting the test cable down that he had any authority to tell them the kind of cable they should use. His lines, as he took it, were to be assured of the efficiency of the proposed cable, and to see that every legitimate effort was made to hasten its being put down, but to leave the selection of the particular kind of cable to the company. In view of the fact, too, of the legal entanglements which now exist between the company and the Board, he had consulted the counsel of the Board in regard to his proper action, as based on the resolution passed by the Board, and he had acted strictly in accordance with the opinion of the counsel. In order to ascertain if the test cable could be put down in any shorter time than the United States Company had said they could do it in, he had consulted other companies. The Standard Underground Company could do it in 45 days, instead of 55.

The Bishop Gutta Percha Company had no cable in stock, but could make one in four weeks: so he had asked the representative of that company to come there, and he was then present to give the Board full information as to what could be done.

Commissioner Gibbens said that as the United States Company wanted a certain time to get in their cable, the Board had better grant it, which was agreed to.

On Nov. 13 last, a resolution was passed to the effect that all companies having electrical conductors along the lines of the subway should have 90 days notice to put them underground.

Commissioner Gibbens said as that notice would expire on the Feb. 21, he should like to know the feeling of the Board with regard to further action. The matter was deferred until the next meeting, which was fixed for the 25th.

On motion of the Mayor it was resolved that the police be notified that there are no permits in existence now for the construction of pole lines, or the stringing of wires; but it was to be understood that this motion does not apply to repairs.

The Canadian Electrical Society of Montreal.

A meeting of the Canadian Electrical Society of Montreal was held on Jan. 7, in the Medico Society Rooms, Phillips Square; the President, Dr. Smith, in the chair. There a large attendance of members, and the meeting was of a very interesting character. Mr. Edison, of New York, and Professor Apostalti, of Paris, were elected honorary members.

The "Wheatstone Bridge" and galvanometer combined for testing leaks in cables was exhibited, and the action explained by Mr. Lampard. Some samples of pure chromic acid were shown, which would take the place of bichromate of potash in the bichromate batteries, and over which the pure chromic acid has many advantages.

An interesting paper was read by Mr. Jannard on the induction coil, its different uses as applied to telephoning and electro-medical apparatus. The history of the induction coil was traced from the time of Faraday down to the present day. Its use in the telephone was explained, and it was shown how, by a simple addition of Mr. Jannard's, it could be used as a "call," thus doing away with magneto bells, etc.

Mr. Jannard also exhibited several specimens of wire of different gauges, and a compact little medical battery of Gaiffe's latest make.

Dr. Smith exhibited a portable battery for a continuous current in medical work, of an entirely new pattern, with a new exciting fluid. The advantages claimed are that the elements may be left in the fluid without waste when the apparatus is not in use. A number of questions were asked by members and answered, thereby eliciting a great deal of valuable information.

At the meeting of the society on Feb. 14, three new members were admitted and two proposed, bringing the membership up to 75, though the society has been only a year in existence.

The principal business of the evening was an exhibition of electrical apparatus, which was literally taken to pieces and the different parts discussed. The discussion at times took a lively turn. Some interesting points were brought out in connection with the duration and life of batteries and the advantages of amalgamating zincs. Dr. Brown proved by experiment that the mercury existed throughout the entire thickness of the zinc. Dr. Smith exhibited the Bailey rheostat and explained its advantages over all other means of controlling the current.

Mr. Kimball, of the Royal Electrical Light Company, gave some interesting explanations as to converting high tension currents into low incandescent currents for house lighting, which he stated was accomplished by means of induction.

The question of executing criminals by electricity was also discussed. Other questions connected with electricity were taken up by several of the members present. The session was one of the most interesting yet held by the society.

The Sprague Road at Asheville, N. C

Asheville, N. C., has now one of the most successful, if not the most successful electric railway in the South, and the president and directors of the road express themselves as very well pleased with its operation. This road was equipped by the Sprague Electric Railway and Motor Company, and uses the regular system of overhead wiring with small No. 6 wire as a working conductor, which is the only wire suspended over the street. The latest improvements which are used on the Sprague roads have been adopted here. Each car carries the new Sprague lightning arrester and is equipped with the universal moving trolley arm which has proved so efficient and yet inconspicuous.

At the opening of the road two weeks ago there were a large number of visitors present who accepted the invitation of the superintendent of the road, Mr. J. H. Barnard, to participate in the trial trip of the cars over the electric road. Accompanied by the directors and the president the party started from the city terminus of the road, riding in the electric cars to the depot of the W. N. C. R. R., which is the other terminus of the road. On the way back, the cars were stopped at the foot of one of the heaviest grades on the line, and a team of six good horses were attached to one of the rear cars to show the difference between the speed of cars propelled by horse-power and by electric power. Although the car was equally loaded, the first cars, propelled by Sprague motors, climbed the hill with perfect ease, stopping whenever their occupants wished to laugh at their less fortunate companions, who were laboring slowly along far in the rear. The Asheville *Citizen* says: "The gentlemen in the last car decided that they did not wish any more one-horse railroad, nor six-horse railroad hereafter. The working of the electric system was absolutely perfect. A representative of this paper made a point of interviewing the Mayor, each Alderman, and as many other guests as he could meet, asking, 'How are you pleased?' But one reply, 'Splendid, far better than I ever imagined it could be done," greeted his ears, and in this response he most heartily concurs." Besides this electric railway, there are, by the way, a large number of stationary Sprague electric motors in operation in Asheville, doing a great deal of the business in that city. The *Citizen*, and one or two other of the leading papers, are printed by electric power, and a large number of other industries are using this same reliable and economical means.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
163-177 POTTER BUILDING, NEW YORK, Feb. 25, 1889.

Edison Isolated Plants.—Mr. F. R. Chinnock, the contractor for the Edison system in Brooklyn, reports installing during the past week a plant on the Pennsylvania Railroad annex boat of 350 lights; and one of 100 lights at the Eagle Oil Works, Claremont, N. J.

Lights for the U. S. Colombia.—Perez Triona & Co., 16 Beaver street, are the proprietors, I understand, of the new Bogata Electric Light Company, which has recently been organized. There seems to be good opportunity presented for the introduction of American lights in the U. S. Colombia, and through Central America generally.

Cordley & Hayes announce their association together in the general commission business at 37 Barclay street, New York, with branch office at 46 Federal street, Boston, Mass., succeeding to the business of the Union Indurated Fibre Company at those points. The firm will confine themselves exclusively to the handling of indurated fibre ware.

The Norwich Insulated Wire Company, of 18 Mercer street, J. B. Atherton, president, are moving to the centre of trade by shifting from Norwich to New York. They cover the wire with paper insulation and then coat it with lead. It is particularly recommended for underground work, and I hear the telephone companies are more than delighted with it.

Out of Town News.—I hear that the Mauch Chunk, Pa., Electric Light and Power Company are talking of putting in an arc and incandescent plant, and that the work will be carried out very shortly. I am informed also that Johnstown, N. Y., will want a 500-lamp plant this spring, and that Morristown, N. J., Electric Light Company, Mr. J. Vorhees, president, talks of equipping an electric railroad.

Hoisting Apparatus.—Mr. J. S. Mundy, manufacturer of hoisting apparatus, 22 to 34 Prospect street, Newark, is looking up the matter of the installation of a 100-light plant in his factory. He is preparing to remodel his shop into one of the most convenient establishments of the kind in the country, using all the latest appliances. What is the matter, I may ask, with the electric motor being used with such work?

The Inaugural Train Excursion, organized by Mr. J. A. Seely, mentioned in my notes a few weeks ago, promises to be a big success. There is every likelihood that the full complement of berths will be sold, and I do not know but that some of those who wish to go are likely to be disappointed. The four days trip, with berth and accommodation en route and in Washington, with all meals, will cost only $25. It seems hardly possible that so much can be done with so small a sum.

The Electrical Accumulator Company, of 44 Broadway report that they have made a complete installation of 112 15 A cells, with Otto gas engine, with all the necessary switch-board appliances, etc., in Chicago, at the elegant residence of Mr. Potter Palmer, the owner of the Palmer Hotel. The plant was turned over on Feb. 18 in perfect working order, and Mr. and Mrs. Palmer are very much pleased. It was impossible to detect the slightest fluctuation of the light, and the hygienic and decorative effects obtained are eminently satisfactory.

The Ostrander Door-Opener.—Messrs. W. R. Ostrander & Co., of 21, 23 and 25 Ann street, have recently brought out the Ostrander door-opener, under the patent of Nov. 6, 1888. The movement is a gravity one, and it is devoid of any delicate springs or any intricate mechanism. The movement is protected by metal sides to prevent dirt, plaster, chips, etc., from interfering with its operation. The movable bolt is of steel drop forging and the other parts of the base are wrought iron and steel. This door-opener is operated either by pneumatic pressure or by electricity with batteries, and with either method is calculated to give great satisfaction to all.

Railway Car Lighting.—At the meeting of the New York Railway Club on the 21st inst., Dr. H. R. Waite read a most interesting and valuable paper on "Lighting Cars by Electricity." He went into a very full explanation of the system of car lighting by the Julien storage battery, with details of relative cost as compared with the old system, results, etc., and he was listened to with close attention by the large company present. The room was illuminated by five 32 c. p. and eight 16 c. p. lights, which were run by current from a Julien battery which had been carried from the station in Eighty-fifth street without in any way affecting its efficiency.

The Ajax Lead Coating Company, Drexel building, Philadelphia, have secured the letters patent for Clamer and Hendrickson's lead coating process, and are now calling the attention of manufacturers and consumers of iron and steel to the advantages to be derived from coating with pure lead instead of zinc and tin for other compositions. They use the pure unadulterated pig lead, and coat all metallic surfaces by immersion in a molten bath. There are few things to which such a process cannot be applied and it seems likely that in electricity plenty of opportunity will be found for it, as, for instance, in the covering of telegraph wire, the preparation of pipes and tubes, and any other work of like nature.

Mr. J. C. Hatzel, 10 East Fourteenth street, is a contractor for Edison central stations and isolated plants, electric railways, etc., as well as electric light wiring, as authorized by the Edison Company and according to the rules of the Board of Fire Underwriters. Mr. Hatzel is an old New Yorker, and has been traveling through the country doing contract work under the Edison system. He completed recently the Newport new Edison station, with a capacity of 2,000 16 c. p. lamps. Among some of his plants are those at Middletown, Del.; Amsterdam, N.Y.; Baldwinsville, N. Y.,and Erie, Pa. At the present time Mr. Hatzel is wiring the big Eastman abattoirs uptown on Eleventh avenue on the Edison plant recently contracted for by Mr. C. A. Benton.

The McIntire Joints.—Messrs. C. McIntire & Co., 36 Crawford street, Newark, N. J., have recently invented, and are now securing patents on, several new styles of their well-known joints, these being new style of terminals, composed of O and C shaped contacts, so that they can be slipped under the binding screws, or the screws can be passed through them. These terminals are composed of pure copper. The lug is soldered to the tube. The terminals, with the tube attachments, are made for every size of wire, so that the wire can be run into the tube and the tube compressed over it making a contact that is solidity itself. These terminals are especially valuable for switch boards, telephones, ceiling or branch cut-outs, and for a great many applications where small stranded wire is in use. Large terminals of the same general type are made specially for dynamos and electric light switchboards.

The Continental Dynamo.—Mr. Peter Claus, the active General Manager of the Continental Dynamo Company, 42 Exchange place, informs me that they have taken a larger factory at 162 and 164 West Twenty-seventh street, where they will be more conveniently situated, and where they will be able to manufacture their dynamos at much less cost. The factory has 75 h. p. available for machine purposes, and is now being fitted with a complete line of the latest machinery by Manning, Maxwell & Moore, of 111 Liberty street, and I understand E. E. Garvin's machines will be prominent. It is said that the company will have one of the most handy and complete outfits for the manufacture of dynamos and electrical apparatus to be found anywhere. They have a number of large machines completed for deposition electric lighting, etc., and are now turning out three 3,000 ampère machines for special deposition work.

Schenck Belt Holder.—I hear that among the most interesting features of the recent display at Chicago was the Schenck belt holder and shifter. Mr. E. P. Gleason, of the E. P. Gleason Manufacturing Company, has acquired a large interest in the Schenck belt holder, and will give the management the advantage of his years of experience and well known business ability. The success so far achieved by the shifter is due both to the merit of the invention and to the hard work done in introducing it. Mr. H. W. Hedge, the secretary, tells me that the demand has so increased as the value of the machine as a money saving device is becoming apparent, that the present facilities and capital have been wholly inadequate. In future the manufacturing will be done mainly by the Gleason & Bailey Company, Seneca Falls, N. Y., and their high standard of work is shown in a perfect working machine. All the popular sizes will be carried in stock and the promptest shipments can be expected.

John A. Roebling's Sons & Co., manufacturers of bare and insulated wire, H. L. Shippy, General Manager, 117-119 Liberty street, N. Y., have been completely remodeling their offices and salerooms so as to include the old department renovated and handsome reception rooms in addition. The front of the store has been fitted out to carry a full line of insulated and bare copper wire, the book-keepers and assistants are on the left of the store, and on the right the first department is a reception room handsomely furnished in leather and adorned with statuary and other works of art. Beyond this is Mr. Shippy's office, on entering which one is immediately struck with a beautiful large case filled with original Japanese *objets d'art* and bric-a-bac, which Mr. Shippy brought home with him last year after his tour round the world. Here Mr. Shippy is to be found busily at work surrounded by his secretaries and stenographers. The woodwork is in ash, and the offices are well lighted, the use of the incandescent lamp being particularly agreeable and pretty.

The Fort Wayne Jenney in New York.—I note an article in the *Financial and Commercial Times* of this city bestowing the highest praise on the Slattery alternating system as introduced to public notice in this city in a very practical and substantial way. After describing the apparatus, which is familiar with your readers, the article says: "The proprietor of the system is the Fort Wayne 'Jenney' Electric Light Company, of Fort Wayne, Ind., and a sub-company is now in operation in New York City, known as the Manhattan Electric Light Company, which has erected the the largest plant for incondescent electric-lighting in the country, at Eightieth street and Avenue B, with a capacity for supplying 100,000 lights, and has started in with supplying 20,000 at once, Macy's store, at Fourteenth street and Sixth avenue, being among other places supplied. All plants operated under this system have resulted satisfactorily in regard to economy, ease of regulation, illuminating qualities and in all other respects. The Fort Wayne 'Jenney' Electric Light Company has established a branch office in New York, in the Boreel Building, 115 Broadway, Room 45, Mr. H. C. Adams being here in charge of the Eastern Department, and he will cheerfully give all information in regard to the system, and references to existing installations to those desiring to establish plants."

The Daft Motor System.—The Electric Power Company, of 41, 43 and 45 Gold street, this city, using the Daft system for the distribution of electric power, are still growing rapidly. The demand for power more than equals the output, and increases so rapidly that the company will very soon have to increase their facilities again. They are now running eleven 50 h. p. Daft generators all day, and also running their machines at night to meet any special demands. They are supplying a large number of well known establishments in their district, and some of the plants have been running along now for three or four years with the utmost satisfaction. I believe such work is unparalleled, as the company do an independent power business, and use the Daft apparatus and inventions throughout, including generators, motors, switches, cut-outs, and every other necessary feature of an efficient system. The company are now installing a complete plant at Newark, N. J. The new building there will be 40 by 70 and three stories high. The plant will be of no less than 300 h. p., and will probably soon have to be doubled up, as over 250 h. p. has already been engaged. Hewes & Phillips, of Newark, are putting in a double Corliss engine of 350 h. p. to drive the generators. Some idea of the extent to which electric power is growing in New York City may be formed from the fact that he Electric Power

Company is now furnishing 30 h. p. to one customer alone from the Duane street station.

The Empire City Electric Company, of 15 Dey street, has just issued a magnificent illustrated catalogue and price-list of 128 pages, with hundreds of cuts, embracing all the novelties, specialties and standard goods that they manufacture or deal in. Under the presidency of Mr. O. E. Madden, and the vice-presidency of E. T. Gilliland, the company has already been making one of the strongest of bids for public favor and patronage; but it has now added materially to its forces by the acquisition of Mr. H. D. Hall, who is to act more particularly as the representative of the company in its contracts and arrangements with electric light and power companies. Mr. Hall is very well known in the electrical business, and his acquaintance with the subject is not confined to one field, but ranges over many branches, so that he is eminently qualified for the new and responsible duties he has assumed. Mr. Hall informs me that it is the desire and intention of the company to have nothing whatever to do with construction work, but to combine its energies simply and solely to the development of its large business in the line of electrical supplies. While strengthening its old connections the company has of late been making a number of new friends and influential associations, and its resources under the new regime are equal to the execution of the largest orders that can possibly be put in its way. Owing to its close affiliation with manufacturing industries, particularly in wood work, it can make contracts for material that are perfectly surprising, so that the company has every confidence in building up an immense trade throughout all sections of the country that it can reach by its energetic salesmen and by judicious advertising. Mr. Hall considers the outlook at the present time quite a bright one, as the rapid extension of the electric light and the growing popularity of electric motors and railways, to say nothing of the thousand and one little conveniences that electricity brings into the house, are creating an insatiable demand for just such goods as the company is best qualified to supply. I must confess my pleasure in greeting Mr. Hall in his new alliance and in his new quarters and have every reason to believe that the Empire City Company has entered upon a career of new prosperity. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, 146 Franklin St. and 149 Congress St.
BOSTON, Feb. 25, 1889.

The Franklin, Mass., Electric Light Company, is again making additions to its handsome station. It has just ordered a 100 h. p. engine of the McIntosch, Seymour & Co., make.

Change of Address.—Mr. Wm. O. Webber, consulting engineer, has removed his offices to larger and more commodious quarters at No. 65 Sears building, corner of Washington and Court streets, Boston, Mass.

The Middlesex Electric Light Company, of Lowell, Mass., has applied for a charter under the Massachusetts law, and the reorganization of the company is in the hands of the corporation's counsel, Hon. Geo. F. Richardson.

Removal.—Mr. Robert Huston, Boston, the New England agent of the Heine Safety Boiler Company, informs me that the headquarters of his company in St. Louis, Mo., have been removed from 102 North Main street to 706-708 Bank of Commerce building.

Knickerbocker Telephone Company is the name of a new enterprise just established in your city as a sub-company to the National Telephone Manufacturing Company, of Boston. Dr. H. E. Townsend is credited with being the prime mover in the new company.

Large Isolated Plant.—The Pacific Mills Company, of Lawrence, Mass., has completed its new building, and has contracted for a plant of 650 incandescent electric lights with Messrs. Paine & Francis, New England agents of the Edison United Manufacturing Company.

Castings for Dynamos.—Messrs. Goodnow & Wightman, the leading hardware firm of Boston, are making a specialty of furnishing castings to electrical students and others for constructing dynamo machines and electric motors. This firm also deals extensively in electrical apparatus and supplies of all kinds.

Mason Reducing Valves.—Quite a number of the large steam plants connected with electric light stations have in use the reducing valve manufactured by the Mason Regulator Company, of Boston. Several superintendents of electric light stations have expressed themselves as highly satisfied with the valve referred to.

New Electrical Supply Firm.—Messrs. F. C. Spaulding and H. A. Buck (under the firm name of Spaulding & Buck) have established their headquarters at the Hathaway building, Boston. They have been appointed general agents for the Eddy electric motor and exclusive selling agents for New England for the Continental dynamo.

Electric Light vs. Telephone.—Advices from Woburn, Mass., state that electric light and telephone companies of that city have been having a quarrel over their respective rights as regard the running of wires. It is reported further that the latter company removed the wires of the former from all the poles used for telephone service.

Schaefer Incandescent Lamps.—Work has been active at the factory of the Schaefer Electric Manufacturing Company, Cambridgeport, Mass., during the past month. The extraordinary demand for Schaefer incandescent lamps has compelled the company to increase its working force and to work overtime nearly every night since the beginning of February.

The Sprague Road, in this city, has not only carried thousands and thousands of passengers already, but has been visited by many hundreds of New England celebrities, local officials, street railway magnates, members of the State Legislature, and the Governor of the State. One and all have been greatly pleased, and the result of their impressions is even now making itself felt.

New Telegraph Company.—State Senator Henry Russell has organized the Champlain Telegraph Company, an offspring of the Commercial Union Telegraph Company, to operate in the Adirondacks. Mr. M. J. O'Bryan, of Plattsburg, will be the superintendent. The contract for the construction of the lines has been let to Mr. George Lynch. Its terminus will probably be Lake Placid, and it is to be completed by June 25.

Elegantly Furnished Offices.—The private offices of Manager Magee, of the isolated incandescent department of the Thomson-Houston Electric Company, and of Manager Alexander, of the Sawyer-Man Electric Company—both of which are in the Hathaway Building, Boston—are models of exquisite taste. In both cases no expense has been spared in making everything harmonize, whether carpets, furniture, curtains, or the frescoing and panel-work. Both offices are lighted with incandescent lamps.

Edison Lights at Newport.—Advices from Newport, R. I., under date of Feb. 21, report that the Edison Electric Light Company, organized here to-day, by accepting the charter granted by the legislature; and by the election of the following directors: Cornelius Vanderbilt, L. L. Lorillard, Ogden Goelet, A. C. Titus, T. M. Seabury, R. C. Derby, R. L. Willing, John Whipple and F. S. Hastings, secretary of the Edison Electric Light Company. The directors elected L. L. Lorillard president and John Whipple secretary and treasurer.

Squabble about Electrics at Revere.—At a special town meeting held in Revere, Mass., on Tuesday evening, Feb. 19, it was voted not to borrow and expend the sum of $1,800 for an electric light plant. On Jan 21 a vote was passed at the regular town meeting to authorize the select committee of the town to raise the amount named and purchase an electric light plant and to maintain and run it at the town's own expense. The necessity of the special meeting was caused by a temporary injunction ordered by Judge Devens in the Supreme Court on Feb. 7, at a hearing on a bill in equity to restrain the town from purchasing a plant and making further arrangements to light the town of Revere by electricity.

Like "Phœnix from the Fire."—Mr. A. L. Russell of Boston, has fully recuperated from the effects of the conflagration which recently destroyed his property and most of his stock of telegraph and electrical instruments and other electric supplies. Mr. Russell has leased an entire floor at No. 100 Sudbury street (up two flights of stairs), just a few doors below his old stand; and, has stocked the premises with a full and complete line of electrical and scientific instruments of all kinds, and a large and varied line of electrical goods and electric light supplies. Mr. Russell has sold out his manufacturing department, and the good will of the same, to Messrs. Holtzer & Cabot of Boston, and will hereafter confine his business operations to the sale of electrical supplies, instruments, etc., etc., and will also do repair work.

The Rogers Auxiliary Alarm is doing good work. Some time ago a serious conflagration was undoubtedly averted at the Parker House, Boston. More recently the factories of the Household Sewing Machine Company, at Bridgeport, the Gorham Manufacturing Company, at Providence, and Washburn and Moen Manufacturing Company, at Worcester, were saved from enormous loss by the prompt action of this reliable apparatus. Hotel people, manufacturers and theatre owners are beginning to understand and appreciate the merits of the Rogers auxiliary fire alarm, and orders are rapidly being received by the parent and sub-companies. The Massachusetts Auxiliary Company in particular, whose offices are at 178 Devonshire street, Boston, are daily in receipt of orders for the system referred to.

Personal.—Messrs. Chadbourne & Hazelton, the Philadelphia agents of the Sprague Electric Railway and Motor Company, were in Boston last week.

Mr. J. W. Chipman, of Indianapolis, Ind., who has for several years been identified with electrical enterprises in the West, is at present sojourning in Boston.

Mr. Albert Lucien Clough, son of Judge L. B. Clough, of Manchester, N. H., is attending the electrical class at the Massachusetts Institute of Technology.

Mr. John T. Bradbury has tendered his resignation as manager and superintendent of the Middlesex Electric Light Company, of Lowell, Mass., to take effect March 1, 1889. He has been with the company six years; in fact, from the commencement of the use of electric lights in Lowell. This company's plant is one of the most successful in New England, and Mr. Bradbury leaves the property in first-class condition, and has the respect and best wishes of the officers and stockholders.

Checking a Fire in Time.—The Providence papers of Feb. 12 give accounts of what might have been a very bad fire, at the big Gorham establishment, in that city. The circumstances are rather striking: The factory is equipped with the Rogers auxiliary alarm system of the Alarm Box Controller Company, and it appears that one of these boxes sent in an alarm, automatically, for a fire that even the watchmen in the building could not find, but which soon gave unmistakable evidence of being there for business. Its very existence was denied to the firemen when they arrived, but they found plenty to do in a short time. The place is insured for $500,000, and but for the alarm the Gorham Company would have lost the entire plant. If this piece of work be added to that done in the Parker House, it will be seen that the Rogers system has earned its way to popularity, and that within two years. Of course it is understood that the company make no claim that their system is "automatic," in the strict sense of the word, if no one is on hand to press the button, but if fire reaches the boxes they will assuredly be 'heard from" at once. The Rogers service is eminently useful and meritorious, and is destined now, I think, to have the biggest kind of a run.

North Brookfield, Mass.—A special dispatch from North Brookfield, of Feb. 14, says: "Two rival companies—one an electric light company and the other a gas—are struggling for the privilege of lighting the houses and the streets of this town, and the contest is becoming warm. The North Brookfield Electric Company, with two North Brookfield men as its officers, was the first to appear in the field; it is organized and incorporated with Francis Batcheller, of the firm of E. & A. H. Batcheller & Co., as president, and B. H. Smith, a young dry goods merchant here, as treasurer. The other company is the Quaboag Gas and Electric Light and Heating Company, and it is not as yet organized. Henry W. King, of North Brookfield, and Luther Hill, of Spencer, are prime movers in this project. The capital stock of the electric company is placed at $15,000, with $11,000 subscribed, while that of the gas company is at $100,000, of which some $700 has been taken in North Brookfield and a few more shares by outsiders. A hearing was given last evening by the selectmen, upon the petition of the electric company, to be allowed to erect poles and run wires, and the matter was taken under advisement by them until this morning, when the petitioners were given leave to withdraw. The citizens generally criticize this action of the selectmen, and many who were previously indifferent are now openly in favor of the electric company. A hearing will be given at some future date to the other company, who is to present its petition next Monday evening." W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., Feb. 25, 1889.

Mr. C. F. Cole, of New York, was in this city last week on business connected with the Westinghouse Company.

The Steamer "Republic."—An incandescent plant has been placed on the steamer "Republic," which runs on the Delaware between this city and Cape May.

Baltimore, Md.—The new building which the Brush Electric Company is erecting in Baltimore is nearing completion, and when ready will also contain the machines of the United States and Westinghouse Companies.

Mr. J. B. De Lery, general manager of the Wenström Electric Light Company of Baltmore, has just placed an 800 light Wenström machine in the St. James hotel of that city: This is the second Wenström dynamo purchased by the St. James, the first beng a 400 lighter.

Mr. William S. Heger, the general agent of the Edison Company, with headquarters is Wilmington, has just contracted to put plants in large manufactories at Norfolk and Portsmouth, and in the hotel at Green Briars, White Sulphur Springs.

Conshohocken.—At the coming election the question will be determined whether or not the local electric light company shall continue to light the town. Claims of inefficient service have been frequently made, and unless an improvement is speedily noticed, it is said that a return will be made to the yellow gaslight.

Post Office, Baltimore.—The contest for lighting the new post-office building at Baltimore has become spirited. Besides bids from the parent companies, all the local electric light companies and electricians have filed their papers. The award will probably be made next week, and in the meantime the anxious seat is crowded.

Electricity is Life.—The following story claims origin in Wilmington, Del., but, unfortunately, an affidavit of veracity does not accompany it: "A parrot belonging to Deputy Collector of Port Samuel H. Black, of New Castle, apparently died on Saturday, but on Tuesday, after receiving an application of electricity, it was brought back to life."

A Lecture on Dynamos.—The lecture on "Construction and Use of Dynamos," by M. D. Law, was attentively listened to on Saturday evening by a large audience at the rooms of the Philadelphia Electrical Society. The next address will be given on Saturday evening by Dr. Hartman, on "Electrical Appliances Used in Dental Surgery," which will probably be of interest.

Messrs. James A. Taylor & Co., makers of standard gauge tools, have letters recommending their goods from the Edison Machine Works, U. S. Electric Lighting Company, Brush Electric Company Weston Electric Instrument Company, Ball Electric Light Company, Thomson-Houston Electric Light Company, Edison Company, at Montreal, and the Indianapolis Jenney Company.

The Media, Pa., Electric Light, Heat and Power Company organized on Monday evening last by the election of the following officers: President, Henry C. Howard; Secretary, James S. Cummins; Treasurer, John T. Reynolds; Directors, Samuel W. Hawley, T. V. Cooper, H. C. Howard, S. C. Shortlidge, H. C. Snowden, W. R. Newbold, Isaac L. Miller, Jesse M. Baker and John H. Hawkins.

The Wilmington Electric Light Company, has lately placed in its central station at Fifth and Tatnall streets, two 1,250 light Edison machines, which are driven by a 200 h. p. Armington & Sims engine. The Schieren and Ireson link belts are used throughout the station, and Captain Smith, the superintendent, is highly satisfied with the work performed by these drivers. This company furnishes business houses also with arc lights, taking current from two 75 light Ball dynamos, placed by the Novelty Electric Company, of this city. The light is admired very much in Wilmington on account of its steadiness.

The Murray Glass Works.—I am very glad to be able to report that the first news of the fire at the big glass works of James J. Murray & Co., of this city, was very much exaggerated. The fire was entirely confined to the cellar, and has therefore done very little damage excepting to the floor of the glass house under the furnace. The concern were only compelled to shut down for one day, and, as I said in my last notes, there was no interruption in the ability to fill orders. Electric light men, so many of whom have come to form the highest estimation of the goods of this well-known concern, will be glad to hear that they are continuing their usual large capacity, and that the demand is being met with the wonted promptness.

Cobb Vulcanite Wire.—An interesting feature connected with the testing during last week of the cables made by the Cobb Vulcanite Company, of Wilmington, Del., was the locating of a "dead fault" in the insulation of a cable whose entire length was 2264 feet. Professor Carl Hering, who was trying the cable, calculated that the fault was located 362 feet from the outside end. Upon examination a break was found in a joint 362 feet ½ inch from the end named by Professor Hering. It is hardly possible that greater accuracy could be atttained than this, and Mr. Cobb was greatly pleased. The business at these works continues good, and is constantly increasing. Mr. Cobb is receiving letters daily commending his cable for its high conductivity and good service.

The Jackson & Sharp Company, car builders, of Wilmington, Delaware, has in its extensive works the largest and finest individual electric light plant in the State. It was put in by William S. Heger, general agent for the Edison Company, and was in complete operation for the first time last Wednesday evening. The plant consists of 1,000 16 c. p. incandescent, and 42 are lights of 2,000 candle power each. The current is produced by two dynamos, one of the Brush pattern, which had been used at the works before, and the other an Edison machine. Power is furnished by a fine Ball engine. The engineroom is fitted up with most improved electric appliances. The fittings and combination fixtures in the works and offices are of the highest type of the maker's art, and several new and pleasing designs of electroliers are noted. The first illumination was a grand success, and was witnessed by a large party of ladies and gentlemen, guests of the firm.

Value of Electric Light Stocks.—In an article commenting on the market value of electric light companies' stock, a local paper has the following regarding an electrical institution of this city which is popularly supposed not to exist: In the way of local companies those gentlemen who hold the preferred stock of the Philadelphia Electrical Trust have made a pretty good thing out of it. There are 5000 shares of a par value of $100 each, and they are now quoted at about $145. They are guaranteed 8 per cent. The common stock, which amounts to $3,000,000, is quoted at from 33 to 35, and earns about 2 per cent. The Electrical Trust has a controlling interest in all the local arc light companies, and carefully sees that no one encroaches on another's territory. Thomas Dolan, the President of the Trust, John Lowber Welsh, R. H. C. Hill, William G. Warden, George I. McKelway and William Wood are some of the gentlemen who are credited with having added to their incomes by their investments in the Trust. E. W. E.

WESTERN NOTES

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Feb. 23, 1889.

Alliance, Ohio.—The Alliance Street Railway Company, of Alliance, Ohio, are putting in a 25 arc light plant of the Thomson-Houston system.

Austin, Minn.—The Western Department of the Thomson-Houston Company has just shipped 600 alternating incandescent lights for installation in Austin.

Kansas City Wires.—The local *Globe* publishes letters, elicited by its inquiry, from G. W. Stockley, Elihu Thomson, J. F. Morrison, A. V. Garratt, W. Hochhausen, A. J. De Camp and Hugh

O'Brien, more or less against the burial of arc light wires. The time is not ripe, they say, for any such work.

Parker-Russell Manufacturing Company.—This company, so well identified with the electric light industry as the manufacturers of the "Sunlight carbon," recently removed into handsome and convenient offices in the American Central Building, St. Louis. They report a satisfactory increase in the output of their goods.

Chattanooga, Tenn., to Have an Electric Road.—A special from Chattanooga, Tenn., dated Feb. 14, says that an application was that day made for a charter for an electric railroad from that city to the famous battlefield of Chickamauga. It will be 10 miles long, and will be operated by electricity as a motive power, and will cost $200,000.

An Electric Road For Chicago.—At a recent meeting of the residents of Taylor street, Chicago, if was decided to sign a petition to the city council asking for a franchise for the West Side street railway to run an electric railroad on Taylor from Canal street to Western avenue. In consideration of this the company is to build a bridge across the river on Taylor street. The matter was referred to the street car company and an answer will be given at a meeting shortly.

Pond Engineering Catalogue.—I am in receipt of a neat catalogue justpublished by the Pond Engineering Company of St. Louis. The catalogue contains cuts of the Armington & Sims engine, and the Lane & Bodley Corliss engine, for which they are the agents, feed water heaters, among which are the the Hoppes and the Lowe heaters, pumps, and other goods. One portion of the pamphlet is devoted to fac-simile letters, which are in every way complimentary to the company and their work. This well-known engineering company are doing a large amount of steam work in connection with electric light plants, making that a specialty.

To Photograph a Burglar.—A special from Dubuque, Ia., dated Feb. 14, states that an application for a patent for an electric light method of instant photograph has been made by two gentlemen of that city. The application is designed especially for the detection of burglars. The apparatus can be so arranged that a burglar in entering a bank, office or dwelling will in his operation touch something which will cause a flash, and the result will be his photograph left indelibly on the plate. A number of cameras may be placed in the room and a variety of views taken simultaneously. The tell-tale wire can be fastened to the knob of the safe or door, so that he cannot avoid touching it, thus disclosing his identity.

Wires in St. Louis.—A special dispatch from St. Louis of Feb. 16 says: "To-night Mayor Allen signed and sent to the City Council, with his approval, the ordinance granting to the National Subway Company the right to lay conduits for the conveyance of electric wires underground. The system which will be used is that known as the Dorset patent. These patents are owned by the National Subway Company, and it is now certain that work in laying the conduits under the streets and alleys of the city will commence early in March, and that during the coming season the work will be far enough advanced to accommodate all the wire companies now in the city. The next move will be at the State capital, where a bill is pending to compel all the companies to run their wires under ground.

The Storage Battery in St. Louis.—The Electrical Accumulator, Lighting and Power Company, located in the Commercial Building, St. Louis, are the exclusive licensees for the Southwest of the Electrical Accumulator Company of New York. The company are at present lighting the large and handsome Commercial Building, with 450 lights, the accumulators being placed in the third story, with engines and boilers in the basement. The elevators are also lighted by electricity. The plant I may add is about to be extended, owing to the demand for light during dark days. The outlook for the storage battery in this section is very promising, and Mr. D. J. Harris, the general manager, informs me that negotiations are pending for several large contracts. The company are fully organized, the personnel being: Wm. L. Hill, president; Chas. Sutter, vice-president; W. S. Rogers, secretary; Gus. M. Viernon, treasurer; David J. Harris, general manager and consulting engineer. E. L. P.

PACIFIC SLOPE NOTES.

SAN FRANCISCO, Cal., Feb. 14, 1889.

The Rhodes and Keese Electric Co., of Los Angeles, has secured the contract for wiring the New City Hall, Los Angeles, for 800 Thompson-Houston lights. Okonite wire is to be used.

Mr. H. W. Wilson, who as the representative of Frank S. Marr, of Pittsburgh, installed the Westinghouse plant of 1,300 lights in San Diego, has gone to London, where he is to take charge of the 25,000 light installation of the Westinghouse Company there.

San Diego, Cal.—A Brush plant, consisting of two 65 light dynamos, complete with all accessories, has arrived in San Diego, consigned to the California Electric Light Company, of San Francisco. C. R. Lloyd, agent of the company, states that his company is in San Diego for business, and that that business is to secure the lion's share of the arc lighting of San Diego. Both arcs and incandescents will be furnished.

The Henry Railway System.—A novel car has been placed upon the Henry Electric Railway system in San Diego. It is provided with a variable leverage arrangement, but instead of the customary friction band a cam and air pump is used, and the appliance is such that all motions of the car, except reversing, are controlled by a three-way cock. The car is, moreover, provided with air-brakes and a whistle, both operated by air, compressed by the gear pump.

The California Electric Light Company, of San Francisco, is the Pacific Coast agent of the Brush Electric Light Company, and, in a very unostentatious manner, is doing by far the greatest proportion of the electric light business of California. In an article recently published in the *Pacific Lumberman* it is shown that the Brush Company has, during the year 1888, installed 1,608 arc lights in California, including the 130 now being set up in the city of San Diego, making a total of 4,500 Brush arc lights in use in the States of California and Oregon. These, added to the numerous power plants and about 3,000 incandescent lights, make a good showing for the Brush Company's Pacific Coast business. Mr. Geo. H. Roe, the general manager of the company, is looked upon as one of the electrical authorities of the State. Charles R. Lloyd is its special agent.

CANADIAN NOTES.

LONDON, Ont., Feb. 13, 1889.

Electric Lighting.—W. H. Dean, of Toronto, and M. D. Barr, of Montreal, agent for the Edison Electric Light System in Canada, are in the city at present organizing a company with a capital of $250,000. The company proposes to confine its attention to the incandescent system of lighting entirely and will not therefore come into competition with the present companies in street lighting with arc lamps.

ENGLISH NOTES.

LONDON, Jan. 23, 1889.

The Metropolitan Electric Supply Company.—The contract for the whole of the electric lighting plant, including engines and boilers, for the Metropolitan Company's 10,000 light station near Southwark Bridge has, I hear, been secured by Messrs. Johnson & Phillips. There will be five engines and five dynamos, and boiler power equal to 1,100 horses. The alternating system adopted is that of Mr. Kapp, and the Metropolitan Company has fixed the number of alternations at the high rate of 266 per second.

Electric Haulage in Mines.—The question of electric haulage in mines is attracting the attention of our mine owners more and more every day, and several papers dealing with the problem have lately been read before various meetings of mining engineers. At a recent meeting of the Midland Institute of Mining, Civil and Mechanical Engineers Mr. Albion T. Snell gave some interesting particulars relating to the "Precursor," a self-contained electric locomotive, designed by Messrs. Immisch & Co., for a colliery at Wharncliffe Silkstone. As Mr. Snell explained, the difficulties connected with a locomotive of this kind render it necessary to depart from all previous experience gained in tramcar work. Excessive gradients, bad track, and a very confined space have all to be reckoned with, not to mention the fact that the accumulators must have an unusually large output and must be strong enough to stand very rough usage. The weight of the locomotive was fixed in the case of the "Precursor" at between 2 and 2½ tons, and it had to run in a drift 4 feet high by 4 feet 6 inches wide. The motor weighs about 4 cwt., and gives about 4 h. p. at 800 revolutions per minute. The gearing was one of the most troublesome of the mechanical details, as owing to the limited space none of the ordinary forms of simple spur gear were applicable. However, a particular form of nest gear was finally decided on, and has proved very satisfactory. The accumulators also have worked well during the three months they have been in use. One important point connected with the employment of electricity in mines was referred to by Mr. Snell at considerable length, I mean the danger arising from the sparking at the commutator. It has, however, been proved by direct experiment that when a small spark takes place from or in the immediate neighborhood of a large mass, or comparatively large mass, of cold metal, that it is impossible to cause an explosion of fire-damp. If the same spark takes place either from a much smaller mass of metal or from a large mass at a high temperature, an explosion is very likely to ensue. From all this it appears probable that the application of direct current motors will have to be limited to non-fiery mines, and even there it will be desirable to build the commutator with special reference to obtaining a large and massive bearing surface for the brushes. Probably the future for mining work lies with the alternating current motor, in which no brush nor commutator is necessary. But, on the other hand, this introduces the disadvantage of connecting wires which would be liable to be broken by a fall of the roof and other accidental causes, and might lead to equally disastrous consequences.

LONDON, Jan. 30, 1889.

The Overhead Wire Question.—A committee of the council of the Institution of Electrical Engineers has been formed at the request of the Board of Trade, to consider in conjunction with that body the question of overhead wires with a view of drawing up regulations for their control.

The Southwark Subway Electric Railway.—I hear that Messrs. Mather & Platt, of Manchester, have coutracted to supply the City of London and Southwark Subway Company with the requisite service for working their line by electricity. This line, as your readers perhaps recollect, runs from the heart of the city, under the Thames, to Clapham. Edison-Hopkinson dynamos, and a new type of motor will be used. There are to be trains every three minutes and the maximum speed is fixed at 25 miles an hour.

The Chamberlain & Hookham Electricity Meter.—Messrs. Chamberlain & Hookham, the engineers of the Leamington installation, have brought out, and have had at work in that town for the last twelve months, a very ingenious and, I believe, also, a very satisfactory electricity meter. It consists of a permanent magnet made of tungsten steel, with soft iron pole shoes, which are brought very close together. In the narrow space between the poles there revolves a peculiar armature consisting of a disc of copper, having wire wound spirally around the margin on each side. The wire is brought out at either end to a disc which revolves in a mercury cup and makes connection with the main circuit. When the current is passed through, the armature revolves as a motor, but is at the same time retarded by the generation of Foucault currents in the disc. Since the driving force is proportional to the square of the current, and the retardation is proportional to the velocity, the velocity is proportional to the current. Its chief peculiarity is that it is able to run at an excessively low speed without loss of proportionality, and hence it has a range of from 1 to 250. This meter is in use at Liverpool as well as Leamington. It would seem probable that the same principle might easily be applied to alternating current circuits, but at present it has only been adapted to continuous currents. The armature is connected to a recording mechanism in the usual manner.

Ward's Electric Omnibus.—Mr. Radcliffe Ward, the well-known electrical engineer, has for some time been experimenting with a view to ascertain whether or not electric traction applied to omnibuses and cabs is a commercial possibility. The outcome of these investigations is a somewhat ugly-looking car, and the Ward Electrical Car Company, Limited, which intends to devote itself to the construction of electrically propelled cars, carts, vans and other vehicles. At the present moment, so I am told, the company is negotiating with some of our large railway companies with respect to goods and parcels vans. The company is also going into the question of operating dust-carts and similar vehicles. They are further considering the question of establishing special lines of electric omnibuses, and of putting electric "growlers" on our streets. Their proposed operations are, as you see, of a very varied and wide-reaching character. It is surely somewhat strange to find such a mine of wealth in electric traction of this kind. With vehicles running on rails, electric traction by means of secondary batteries has only proved a tolerable success, so that it is difficult to see why it should prove more successful under less favorable conditions. Moreover, putting technical details aside, we are still confronted by popular prejudice, which in this country is not only strong, but on many occasions is very effectual; and in this particular instance the opposition would have a fair case. It is to be regretted, I think, that Mr. Ward did not devote his time and talent to the more promising field of tramcar traction.

The London-Birmingham Trunk Line.—Grave doubts are being expressed in telephone circles with regard to the success of the trunk line, which is now being erected by the United Telephone Company between London and Birmingham, and which business men anticipate will place the metropolis within speaking distance of all our great manufacturing towns and seaports in the North. It is reported that No. 12½ hard copper wire is to be used on this line, and a larger gauge is said to be absolutely necessary to ensure clear speaking between subscribers in the two towns. The resistance per mile of the proposed wire is 5.7 ohms, which means 1,482 ohms for the complete loop of 260 miles. Now the resistance of the Paris-Brussels loop is 1,518 ohms, only 36 ohms more than that of the London Birmingham line. Speaking on the Paris-Brussels line is practically impossible except between instruments included in the loop; and this argue the opponents, will be the case with London-Birmingham, since the loops will be practically identical, the difference of electro-static capacity in favor of the English line, being so small as to be negligible. City subscribers and central Birmingham subscribers will probably be able to communicate with each other without much difficulty; but suburban subscribers will, it is said, (owing to the intervention of iron and underground wires, and electro-magnets) call for each other in vain. It is to be hoped these predictions will be falsified, since great things are expected of this trunk line and failure will mean a renewal of the outcry against the United Telephone Company.

LONDON, Feb. 6, 1889.

Electric Traction on the Underground Railway.—At the last meeting of the Metropolitan Railway Company, the report which was presented to the shareholders contained a reference to the proposed electric traction experiments. According to a letter from Lord Bury, Chairman of the Electric Traction Company, the difficulty connected with working the vacuum brake without the use of steam, which has hitherto been the chief cause of the delay, has now been overcome, and the whole matter is in active progress. It seems also by this letter that it was never intended to employ accumulators for ultimate use on the underground. "The use of accummulators is for a temporary service only, and is rendered necessary by circumstances connected with the traffic, which will disappear when electric traction is adopted on the underground railway." It is, of course, very satisfactory to learn on such good authority that accumulators are only to be a temporary expedient, but such was certainly not the impression which was given a few months ago, while the vacuum brake difficulty proved as yet intractable, and when an electric locomotive was to be at work by October. I may mention in this connection that in a fortnight or three weeks' time a complete service of electric cars will take the place of horse cars on the Barking section of the North Metropolitan Tramway Company. These cars will be driven by accumulators and worked under a two years agreement by the Electric Traction Company.

The Action of Electric Currents on Copper Wires.—A. M. Firmin Larroque has been investigating the question of the deterioration of copper under the long-continued action of electric currents. His experiments have been four years in progress and would seem to fairly establish the fact that the action of long-continued currents is to cause a great alteration in the molecular structure of the copper. M. Larroque takes thirty-six strips of copper each ten millimetres in width and three millimetres in thickness; some are bent into spirals, some into zig-zags, some are annealed and some hard-drawn. A constant current is sent through each strip; in one set it is continuous, in the other it is alternating (75 reversals per second). The strips are suspended from a frame and kept stretched by weights of 10 grammes, the loss of elasticity being measured by the elongation of the spirals. For the first eight or nine months nothing was observed, but after that slow elongation set in, the effect being more marked with alternating than with continuous currents, with large currents than with small. From the fact that all the specimens of copper wires which have deteriorated in this manner, present many of the properties of ordinary electrolytically deposited copper, it might be useful to investigate the effects of long continued currents on conductors built up by electrolysis. We might reasonably assume that there would be no further tendency to an alteration of texture in this case.

THE TELEGRAPH.

Illinois.—A bill has been introduced in the Illinois Legislature to fix telegraph rates, the lowest price being 15 cents for 10 words.

Baltimore, Md.—The Spalding Telegraph Company, lately mentioned as chartered by John G. King and others to introduce a new system of underground wires for telegraph and telephone purposes, have asked for a permit to lay their wires.

Telegraphic Theatrics.—The New York telegraph operators gave a most enjoyable dramatic entertainment and ball on Feb. 19 in Turn Hall in East Fourteenth street. The dramatic skit by Dixon entitled "Dots and Dashes," was performed entirely by talent from the craft, as was also Morton Baker's interesting drama, "Above the Clouds."

An Inventive Operator.—A special dispatch of Feb. 7 from Waterloo, Ia., has the following: It is reported that O. W. Young, a telegraph operator in the employ of the Milwaukee & St. Paul Railroad at Charles City, has solved the problem of making an augur that will make a square hole. He made a pattern augur, and it is claimed by those who have seen it work that it will cut a square mortice rapidly and accurately. A company has been formed and applications have been filed for patents in this and foreign countries.

Telegraphers Form a Club.—Pursuant to a call signed by two hundred representative operators, upward of fifty members of the craft met in one of the parlors of the International Hotel on Feb. 15 to organize a club, social and athletic in character, which was christened the Telegraphers' Club of the City of New York. Permanent organization was effected and officers were elected as follows: President, George E. Holbrook; first vice-president, Geo. W. Hann; second vice-president, R. W. Martin; third vice-president, Thomas W. Greene; secretary, J. C. Watts; treasurer, J. I. Buxton.

Cable Laying in the Gulf of Mexico.—The steamship "Faraday," which is engaged in laying the cable from Coatzacoalcas, Mexico, to Galveston, is now (Feb. 10) lying in the outer roadstead, having come here from New Orleans, where she went for coal. She is said to be the largest ship ever in this port, measuring 365 feet in length, 52 feet beam, and draws 25 feet when supplied with coal. Her officers and crew number 168 men. She has laid the cable at the rate of six knots an hour, and had made 900 miles, being within 100 miles of Galveston when she ran short of coal. She will go to sea to-morrow, take up the end, which was left buoyed, and complete the line to this city.—*Galveston News*.

Heading Off A Sensation.—The *Birmingham Age* telegraphed the *Atlanta Constitution* announcing that it had a startling sensation, and requesting the latter to announce that a special train would bring a large edition of the *Age* to Atlanta for sale by a special corps of newsboys. The *Constitution* printed the notice, but a quarter of an hour after the request was received a *Constitution* reporter and a telegraph messenger were whirling towards Birmingham on a special train. They met the *Age* train three hours away from Atlanta, bought a copy, quietly transmitted the "sensation" to the wires and it was put in type in the *Constitution* and was on the street in Atlanta by the time the *Age* train reached Tallapoosa

nearly 100 miles away. The *Age* doesn't think much of the *Constitution* as an advertising medium.

New York's Fire Wires.—The annual report of the fire department recommends that the fire wires be put underground with the least possible delay. Speaking of the blizzard of March 12 and 13 the report says that the breaking and falling of other telegraph wires upon the fire-alarm circuits put many of the latter almost out of use for from two to three weeks. The underground circuits were not, of course, affected, which demonstrates the imperative necessity of putting the wires underground. The estimate for putting all the wires underground was $300,000, of which but $50,000 was appropriated in 1887.

THE TELEPHONE.

Ohio.—The State Legislature has declared itself against tinkering with telephone tariffs.

The Pacific-Edison Phonograph Company has sent in an order for 200 phonographs.

Baltimore, Md.—The Chesapeake & Potomac Telephone Company talk of undergrounding their wires at a cost of about $200,000.

Pennsylvania is threatened with a dose of anti-telephone legislation, but similar schemes have been defeated before and will be again.

Lake View, Ill.—Messrs. L. D. Tuttle, J. M. Cleaver and W. F. Wiemers have formed the Lake View Telephone Exchange with a capital stock of $72,000.

Anniston, Ala.—The Alabama Phonograph and Graphophone Company, with a capital stock of $150,000, has been organized by Duncan T. Parker, F. E. G. Roberts and James R. Roberts.

Chillicothe, Mo.—The American Bell Telephone Company have caused the removal of the Cushman system from Chillicothe, the courts having determined that it was an infringement on their patent.

Once More for Bell.—U. S. Patent Commissioner Bell rendered a decision on Feb. 23 refusing to re-open the Gray and McDoncugh interferences, and thus once more affirms the priority of Bell.

The Berliner Carbon Transmitter.—Owing to reports in Boston last week that the Patent Office had acted favorably on the long delayed Berliner interference, with the effect of "extending the Bell monopoly," the stock of the American Bell Telephone Company went up several points.

Fredericton, N. B.—Mr. W. A. Haskell, auditor of the Bell Telephone Company, Montreal, and Mr. J. H. Wagstaff, manager of the Nova Scotia Company, are at the "Barker." They came down from Woodstock Tuesday night, where they had been winding up the business of the agency there, and are now arranging matters for the transfer to the New Brunswick Company here. Mr. Knudson, superintendent of the N. B. Company, expects to take possession in a few days, when the work of connecting the Nova Scotia Company's subscribers with his system will be begun.—*Gleaner.*

New York Phonograph Company.—A certificate of incorporation of "The New York Phonograph Company" has been filed in the office of the Dutchess County Clerk. It sets forth that John P. Haines, John D. Cheever, and Richard T. Haines, are desirous of forming a company for the purpose of manufacturing, selling, leasing, or otherwise disposing of machines and appliances appertaining or connected with phonographs and phonograph graphophones and the operation of them. The amount of the capital stock is $1,250,000. The number of shares is put at 12,500 of the par value of $100. The trustees who shall manage the concerns of said company for the first year are: John P. Haines, of Toms River, N. J.; John D. Cheever, of New York City; Richard Townley Haines, Noah Davis, William Fahnestock, W. Seward Webb, and John S. Martin, of New York City.

The Erie Telephone Company makes the following statement of earnings:

Quarter ending Dec. 31.	1888	1887.
Gross earnings	$175,039	$160,070
Net "	52,475	56,296
Construction	10,564	14,408
Surplus	41,911	41,888
Subscribers added	126	89

Total number connected, January 1, 1889, 11,156. Unusual heavy reconstruction was done during the quarter.

Nine months to Dec. 31.	1888.	1888.
Gross earnings	$507,062	$460,279
Net "	170,875	157,822
Construction	29,280	45,412
Surplus	141,595	122,410
Subscribers added	613	666

Mexico.—The following dispatch was received last week from the office of the Mexican Telephone Company, in reply to a telegram from the Boston office asking for an explanation of the reported establishment of a rival telephone company in Mexico: "Fear no opposition. Our position was never stronger. Business improving." The standing of the company has been firmly established during the past year. Its patents have been declared by the courts of Mexico valid and unassailable, after a protracted lawsuit of almost two years. All opposition has been defeated, and the company is entitled to heavy damages done to its business by parties who have endeavored to establish and operate rival telephone exchanges. The amount involved is now being determined by auditors appointed by the court. Numerous overtures have been made by the opposition to compromise, all of which have been declined. It is estimated that this company should receive from $20,000 to $25,000 for damages sustained. The monthly receipts of the company in the city of Mexico alone since last March have increased 50 per cent., and there are good and substantial reasons to expect a corresponding increase during the coming year. This increase, it should be added, is after a falling off in receipts of some 50 per cent. from competition. This loss is now being recovered."

THE ELECTRIC LIGHT.

Lima, O., wants bids on city lighting.

Warren, R. I., is to have an electric light plant.

Vancouver, W. T., is now lighted by a Brush plant.

Woodstown, N. J., proposes to have an electric light plant.

Milledgeville, Ga.—An electric light company has been organized.

Troy, Ala.—Mr. D. W. Branch is asking for terms on a small plant.

Smith Centre, Kan., is to put in an electric light plant within six weeks.

Orange, Mass.—The Opera House has replaced its arc lights by incandescents.

Lachute, Can., is considering an electric light project, jointly with St. Andrew's.

Laurel, Md., is discussing an electric light plant. Mr. J. A. Clark is interested.

The Edison Association is to hold its next convention at Niagara Falls in August.

Easton, Md., has seen a consolidation between its local gas and electric light companies.

Nickerson, Kan.—Mr. C. E. Decker is negotiating to buy the Nickerson electric light plant.

Atlanta, Ga.—The *Constitution* Publishing Company is putting in a plant of 400 incandescent lights.

Frankfort, Ky.—The Frankfort Gas Company will shortly put in a plant of about 50 arcs of 2,000 c. p.

Concord, N. C.—Mr. W. O. Craven wishes to get estimates on an incandescent plant of about 500 lights.

South Pittsburg, Tenn.—Mr. A. C. Green is organizing a company to put in a Fort Wayne Jenney plant.

Washington, D. C.—The United States Electric Light Company are adding two 500 light Edison machines.

Wheeling, W. Va.—The city is seeking power from the legislature to buy and operate an electric light plant.

Hope Mills, N. C.—The Hope Mills Manufacturing Company are putting in an incandescent plant of 800 lights.

Pasadena, Cal.—The Pasadena Electric Light Company is preparing to build a new station and enlarge its plant.

Mobile, Ala.—Mr. H. T. Smith and others have asked for a franchise to erect an incandescent light and power plant.

Dallas, Tex.—The Queen City Electric Light Company has added a 500 h. p. Corliss engine and other apparatus to its plant.

Willimantic, Conn.—The capital stock of the Willimantic Electric Light Company has been increased from $10,000 to $20,000.

Washington, N. C.—Mr. B. F. Rodman is to put an electric light plant in his iron foundry and will probably light the town also.

West Point, Miss.—Messrs. R. N. Dominick and M. E. Corstan will build an ice factory, and will probably add an electric light plant.

Jonesboro, Ark.—Mr. J. B. Dillon and others are interested in an electric light plant which it is intended to put in during the spring.

No More Wild Geese.—Since electric lights have been introduced at Willows, Can., not a wild goose has been seen flying over the town.

Removal of Plant, Washington, Kan.—The Washington electric light plant will move to Haddam on the first train over the K. C., L. & N.

Newbern, N. C.—The Schuyler Electric Company has been awarded the contract for lighting the Exposition at Newbern, N. C., to open on Feb. 19.

North Topeka, Kan.—Messrs. O. Adams and F. Goolman are at work on a new dynamo from which they expect good results in economy of power.

Pulaski City, Va.—It is said that the Swansea Land Company can give information as to an electric light plant that is to be put in at Pulaski City.

Benton Harbor, Mich.—An electric light company for Benton Harbor and St. Joseph, Mich, has been formed by local capitalists, with a capital stock of $25,000.

Kalamazoo, Mich., has called for bids for a plant of 175 horse-power capacity, and dynamos for 150 lamps of 2,000 candle-power each; circuit, thirty-five miles, double lamps.

East Saginaw, Mich.—The Schuyler Electric Company have installed a twenty-five light arc plant in the large lumber works of W. B. Mershon & Co., at East Saginaw, Mich.

Piedmont, W. Va.—The Piedmont Electric Light and Power Company has been formed by G. M. Harrison, J. S. Jamieson, H. G. Burton and others, with a capital stock of $20,000.

Middletown, Conn.—The Schuyler Electric Company have installed an incandescent plant of their own system in the Connecticut Industrial School for Girls at Middletown.

Fernandina, Fla.—The Fernandina Electric Light Company has been organized, with F. W. Hoyt as president and S. D. Swann as secretary, to install an arc and incandescent plant.

Brookline, Mass.—The Brookline Electric Light Company is putting in a Thomson-Houston alternating machine of 1000 lights capacity to light the town hall, police station and public library.

Dedham, Mass.—The Dedham Water Company has withdrawn from the Massachusetts Legislature its petition for an amended charter authorizing it to furnish electric light and power.

Savannah, Ga.—The Brush Electric Light and Power Company has added dynamo capacity for 3,200 incandescents. Hammond Hull & Co. have put a 75 light incandescent plant in their fertilizer works.

Taylorville, Ill.—The Taylorville Electric Light and Power Company has been formed, with a capital stock of $20,000, by W. W. Anderson, J. Bourne, R. H. Brown, J. J. Drennan, and W. H. Kirkwood.

Chicago.—The business men of Thirty-first street, Chicago, are forming an electric light company of their own. Mr. J. McDermott is the president of the company, whose stock has been well taken up.

The Ferranti Electric Light Company, which is now establishing its huge plant on the alternating system at Deptford, near London, England, has 13,000 h. p. of apparatus on the ground. The total plant building is 100,000 h. p.

Eaton, O.—The Eaton-Jenney Electric Light Company, Cook & Aydelott managers, have just added to their plant another building 24 × 34 feet, frame, a 15 × 20 Payne high-speed Corliss engine, and another Jenney series incandescent machine.

Roxbury, Mass.—The Roxbury Electric Light Company has been incorporated, with a capital of $50,000. E. H. Clapp is president, A. C. Burrage, treasurer, the same and F. Ferdinand, J. F. Newton, S. M. Hedges and T. Smith, directors.

Nashville, Tenn.—The Thomson-Houston Electric Company, M. C. Wheaton, agent, have received the contract to light the city, and have organized the Capital Electric Company, to erect the plant. The capacity will be 150 arc and 600 incandescent lights.

Lebanon, Ill.—The city council of Lebanon, Ill., has been negotiating with the Westinghouse Electric Light Company of St. Louis with a view to purchasing a plant for street lighting purposes. A committee has been appointed to examine other systems.

The Mount Vernon, Ohio, Electric Light Company, using the Schuyler system, have received a contract from the city for additional arc lights. The plant is giving the most unqualified satisfaction, and the demand for lights is increasing very rapidly.

Electric Lights in Sing Sing, N. Y.—The village of Sing Sing was lighted up on Feb. 12 with electricity for the first time. The prison is brilliantly lighted up in the same manner, the electric lights having superseded the gas heretofore in use. The incandescent light is the one used.

Winchester, Mass.—The Winchester Electric Light Company built circuits recently to Arlington on the poles of the New England Telephone Company. The wires were cut down by the telephone men, involving damage, it is said, to the tune of $2,000.

Marion, O.—The electric light plant installed by the Schuyler Company at Marion, Ohio, has been accepted by the local company and the cash paid. This plant was put in on approval, and the light was so satisfactory that the whole matter was settled up within thirty days after starting of lights. This is the kind of business that the electric light companies like.

Taylor, Tex.—Mr. H. J. Mendel is getting up a stock company to put in an electric light plant at Taylor, of about 40 arc and 650 incandescent light capacity. He has already met with considerable success, large blocks of the stock being taken, and more "spoken for." The plant is badly needed, and there seems every reason to believe in its commercial success.

Lexington, Mass.—The Lexington Electric Light Company will start the experiment of lighting the town's streets with electricity, when the building which is in course of erection at Woburn is completed. The main streets are to be lighted with arc lights, and the buildings where the lights will be put in as a test will be furnished with the incandescent lights.

Jersey City, N. J.—The Jersey City Electric Light Company has purchased ground near the hill at Wayne and Montgomery streets. It will build a two-story building, 200×150 feet. When it is completed the company's lines will be extended, and private residences will be lighted with incandescent lights. The new building is to be of brick. Work will be begun at once.

St. John, N. B.—A company has been formed in St. John, N. B., to construct plants for electric lighting purposes, and for producing and distributing current for lighting. The capital stock is $150,000. The directors are Jeremiah Calkin, George F. Calkin, George F. Baird, J. H. Grant, F. S. Pearson, W. K. Kendall, and N. C. Buck, of Boston, and F. B. Pearson, of Halifax.

The Belton, Texas, Light and Water Company are now stringing wire and will soon have Belton lit with the Heisler incandescent system. It is understood that Mr. Dan Chamberlin will be president, Nelson R. Smith general manager, and Chas. D. Smith auditor of the company. They have become proprietors of the Heisler system for Texas, and have several plants projected.

Concordia, Kan.—The Electric Light Company are putting in their new $10,000 engine, 128 h. p. It is a Corliss of the most modern pattern, and we will now have light in spite of too much water or too little water, ice, slush or mud. Our electric lights are pronounced by experts the most brilliant in this part of the State, and hereafter the Concordian who observes good hours will never know that there is darkness on our streets.—*Concordia Empire.*

Kingman, Kan.—The Wright Brothers, who originally put in the electric lights at this place, purchased the plant at the sale on Monday. It is not known what they will do with it, but if satisfactory arrangements can be made with the city they will no doubt be again operated here. It is false economy to keep a city of the size of Kingman in darkness, as it has been the past few months, if the cost of lighting is not out of all reason—*Kingman News.*

The Fort Wayne Jenney System.—Fort Wayne is made to realize that there is only one way to retain the Jenney Electric Light Works in that city, and that is to rebuild the establishment recently destroyed by fire, on plans furnished by the company. Otherwise the works will go to Fremont, O., where buildings are offered, free of cost, and natural gas without charge. Peru and Chicago are also offering liberal inducements to secure the plant.

Fort Scott, Kan.—Last night (Jan. 24) the new electric light works steamed up and made connection with all the incandescent lights ready for operation, and for the first time in the history of this city this beautiful light was in operation. Only a small number of the incandescent lights that will be put in were attached last night, but the experiment proves that the plant is in splendid working order, and will be a grand addition to the illuminating resources of Fort Scott.—*Monitor*

Louisville, Kan.—A movement is on foot to establish a joint electric plant in Louisville and Wamego. It is proposed that the mill company of this city furnish the power and Wamego the lighting apparatus for both towns. The enterprise is well worthy of careful consideration. It marks a step in the right direction and cannot fail to establish a more friendly relation between the two towns. The next move should be to connect the two business centres by a street railway.—*Indicator.*

The Westinghouse Electric Company has issued from its Boston office a very neat little folder giving figures as to the annual expense and revenue of operating incandescent electric light stations on the alternating system. The estimates are for central stations of 500, 750, 1500, 3000 and 5000 lights. For a plant of the last size, 5000 lights, the total revenue is placed at $47,250 per annum, and the operating expenses at $19,534. The profit is $27,716, from which of course must be deducted first charges, such as interest on plant, the depreciation, &c.

Kansas City, Kan.—The Central Water-Works and Construction Company, of Kansas City, has filed an application for a charter with the Secretary of the State. The directors of the company are N. McAlpine, A. N. Moyer and R. B. Armstrong, of Kansas City, Kan.; Wyncoop Keirsted, J. C. Gunn, H. B. Pomeroy and Ottis B. Gunn, of Kansas City, Mo. The capital stock of the company is $50,000. Its object is to construct and maintain water-works, gas-works, electric light plants, sewers and bridges throughout the West and South. It will have its headquarters in Kansas City.

Harrisburg, Pa.—Judge Simonton has handed down an opinion on the motion for a new trial in the case, recently reported in our columns, of the Harrisburg Electric Light Company and B. & E. Goodman, the Market street clothiers, in which the motion is overruled and judgment directed to be entered on the verdict. The court thinks the jury were properly instructed, and although the amount of their verdict is perhaps large, in view of the testimony as to the value of the property, it is not so great as to require the court to interfere with the verdict for that reason. The verdict was against the defendants.

Hagerstown, Md.—A charter has been granted to the Hagerstown Electric Company, the incorporators being Chas. E. S. McKee, Thomas B. Cushwa, Jacob Rosner, George A. Davis, Alexander Neil, Geo. W. Smith, Jr., and Chas. E. Dustin. It is proposed to purchase the electric plant installed by the Schuyler Company, which is doing a fine business, and gives unqualified satisfaction. Hagerstown feels good over its light, and it has every reason to do so. The company has a five years' contract with the city, and nearly a thousand incandescent lights are already in use, and the demand is constantly increasing.

A Fight for Light.—A special dispatch from Iowa City, Ia., of Jan. 29, says: The fight between the Gas Company and the Electric Light Company of this city over the ownership of the $50,000 in gas stock hypothecated by J. K. Graves in Chicago, took a new turn to-day. Judge Fairall filed a lengthy opinion refusing

the motion to stay the annual election of directors of the gas company and holding that under the peculiar circumstances of the case the plaintiff's remedy, if any he had, to compel a transfer of stock on the company's books, was not in mandamus but equity. The plaintiff amended his petition in the equitable action by asking an order of transfer and for a temporary injunction.

Florence, S. C.—It is the intention of Messrs. Hodges & Newton, the lumber merchants, etc., of Florence, with Mr. G. B. Edwards, president of the Electric Light & Power Company, of Charleston, S. C., with others, to form a joint stock electric light company in Florence to do a general business. The capital will be about $15,000 at the start, and an exhibition plant of 3 or 4 arcs and about a dozen incandescents will be put in to show the people what the light is like. A large number of influential people are interested in the project and it will undoubtedly succeed. Florence is a lively and beautiful town, booming healthily, and it will give plenty of business to a good pushing company such as that now forming.

New Electrical Apparatus at Cornell.—The Thomson-Houston Company have recently supplemented their generous contribution to the resources of the department of electrical engineering at Cornell, to which they had already given two valuable machines, the one for arc, the other for incandescence lighting, by sending a lot of arc lamps. These lamps represent their best styles and workmanship, and will prove a very useful, and, in fact, indispensable addition to the collections. This lot, about a dozen, is valued at between $750 and $1,000. The Edison Company has also lately sent to Professor Roberts a beautiful collection of samples illustrating their standard makes of incandescent lamps. They are very handsomely cased, and are an interesting and ornamental feature of the Professor's lecture room. The collections of apparatus in electrical engineering bid fair to become as extensive as are those in mechanical engineering. All the principal makers of dynamos and lamps are more or less well represented by their products and all are still interested in making their contributions satisfactory.

APPLICATIONS OF POWER.

Ballarat, Australia, has a Julien storage car in successful operation, with more to follow.

Dallas, Tex.—It is reported that Chicago parties propose to build an electric road and will ask for a franchise.

Cincinnati, O.—Work has begun on the new Sprague Road, over-head system, which is to have 20 cars at the start.

Akron, O., is the scence of a legal contention as to induction roubles between the telephone and electric railway people.

Martha's Vineyard, Mass.—The Martha's Vineyard Street Railway Company is to operate by electricity, using the overhead system.

Omaha, Neb.—Judge Doane has dissolved the injunction restraining the Electric Railway Company, Omaha, Neb., from erecting poles and wires.

Philadelphia.—The *Press* is well pleased with its 15 h. p. Sprague motor, and proposes to apply motors independently to some seven large presses.

Atlanta, Ga.—The Thomson-Houston Company will put in a two mile road as soon as possible for the Atlanta and Edgewood Street Car Company.

Kansas City, Mo.—The Metropolitan Company will, it is said run an electric road on the South-west Boulevard line from Kansas City to Rosedale, Mo.

Elizabeth, N. J.—An electric road is projected for Elizabeth, and an application for a franchise is to be made at the next meeting of the City Council.

Stillwater, Minn.—E. S. Brown, J. N. Castle and others are interested in the Stillwater Street Railway Company, which proposes to go in extensively for electric railroading.

Salem, Mass.—The Beverley and Danvers Street Railway Company has contracted to have its road run by storage. The line will be three miles long. A capital of $15,000 has been subscribed.

New York City.—The Municipal Electric Power Company of New York has been formed by T. F. Hayes, C. H. Pinkham, Jr., F. Warner, W. S. Gray, J. H. Beals, Jr., and F. H. Haar, with a capital stock of $100,000.

Topeka, Kan.—The electric road of the Rapid Transit Company is about ready and will start in a few days. Two cars have already been delivered and 28 more are on the way from St. Louis. The steam plant includes two engines—one of 250 h. p. and one of 600 h. p.

Dubuque, Ia.—The city council of Dubuque has passed an ordinance granting a charter to the Electric Motor Company, but the company refuses to accept it because of a clause requiring them to give $20,000 bonds for the fulfillment of certain conditions in the ordinance.

Good for Boston.—The Boston *Herald*, in a very sensible and able article, has praise to bestow on electricity for street railways, and sees many advantages in its adoption for Boston, even with overhead wires, the system being "much less a disfigurement than it was supposed it would be."

Malden, Mass.—The Malden, Mass., Electric Company has placed a mortgage on its property in Malden, Melrose, Medford and Everett for $100,000. It is said that the company intends to put in in a plant to furnish power to run the street cars by electricity, and also to furnish power from stationary motors.

Spokane Falls, W. T.—For a consideration of nearly $250,000 part of the water power of the Spokane River has been sold to F. R. Moore and his associates, including the Edison Illuminating Company, of which Mr. W. S. Norman is the general manager. Arc and incandescent capacity is to be increased, and great development will be given to electric power service.

Staten Island, N. Y.—The South Beach Railway Company has been organized with the following officers: President, F. H. Steele; vice-president, Adolph L. King; secretary, Edward T. Kauffmann; treasurer, Daniel T. Thompson. The Edgewater Board of Village Trustees are considering the granting of a license to the company to operate a system of electric motor cars on Sea View avenue, Clifton, along the south beach to Petelers.

St. Joseph, Mo.—The Wyatt Park electric line has begun grading on its new extension. The extension is to be built one-eighth of a mile east and one-half south of Wyatt Park, and will be completed as soon as the work can be done. The Wyatt Park line is also contemplating asking for a franchise to North St. Joseph, but as yet has not made up its mind as to whether the project would be beneficial enough to compensate them for the outlay. With the new extension to this line and all the other lines in the city operated by electricity, St. Joseph expects to be the greatest electric railway town in the United States.

Michigan.—In Michigan a large number of manufacturing towns have been agitating the subject of the utilization of water power, in view of the various practical demonstrations of its value, in furnishing electrical distribution for both power and light. Many towns in the State are situated within a few miles of swiftly flowing streams, whose value as an agency of power has never been fully realized, and not a few have waterfalls within their local boundaries. Marquette some time since, as noted in these columns, took the initiative in this matter, the result being what is characterized as an elaborate, and at the same time peculiar, scheme for the supply of the electric current for light and power.

Boston, Mass.—The new Sprague electric snow-plows at the Allston power station occasion universal interest, as they are the first which have been constructed to do this sort of work. Each snow-plow, for the West End Company have ordered two, carries not only a plow but powerful brooms to sweep the snow from the track, snow-scrapers and ice-choppers. Each is propelled by two Sprague 15 h. p. motors, and it is estimated that they would be able to clear a track of snow more quickly than could an ordinary plow drawn by a dozen horses. The choppers upon these electric plows consist of steel pins revolved so rapidly as to chop into fineness the hardest and thickest ice and packed snow, which is thrown off the tracks by the scrapers as fast as atomized.

Brooklyn, N. Y.—The special term of the Supreme Court in Brooklyn will soon have a case of great interest to Coney Island residents. The Atlantic Cable Company some time ago applied for a charter to build a road along Surf and Sea Breeze avenues. The application was made to the Highway Commissioners of Gravesend and was rejected. Lately the same board granted a charter to the Electric Surface Railroad Company for the same route. The cable company obtained an order from the Supreme Court for the Highway Commissioners to show cause why the first charter was not granted. It is charged that Commissioners White and Boyle were actuated by corrupt motives. The defense is that a committee of citizens, after an investigation, favored the electric road.

Holbrook, Mass.—A special dispatch from Holbrook, of Feb. 8, says: "A company was organized yesterday for the purpose of building a railroad in this town, for either a horse or an electric road, to run from the Braintree line via Franklyn street to the Holbrook line, and from the Old Colony station on Union street to the Weymouth and Abington lines. The board of directors are: E. N. Thayer, W. F. Gleason, E. E. Holbrook, Eugene Snell, G. T. Wilde, R. P. Chandler, W. E. White, J. W. Belcher and John Crawford. A company has also been organized in Randolph for the same purpose, to run from West Corner to the Avon line, and from the square in Randolph to the Holbrook station. The board of directors are: J. W. Belcher, J. B. Thayer, Royal Turner, J. J. Crawford, A. J. Gove, C. G. Hathaway, E. N. Thayer and W. F. Gleason.

Omaha, Neb.—Negotiations are in progress between the Omaha-Council Bluffs Bridge Company and John A. Horbach for the purchase of the latter's interest in the Omaha motor line. The deal will probably be closed within a week. It is presumed that the bridge company will operate the motor line when first started from its paved station on the Iowa side, but this is not settled. A right of way for the poles beyond the present terminus at Thirteenth street is wanted, and the motor company is having an argument over this matter with the city. It is possible that the negotiations with the Thomson-Houston Company to build a power house in this city will be renewed. Charles Pullman, agent of the Pullman works, was in this city to bid on an equipment of cars and motors yesterday, but the company was not quite ready for business.—*Omaha Bee.*

New York City.—Preliminary notices in condemnation proceedings have been served on 100 property owners affected by the plans of the City Railway Company, which is to construct an underground road lengthwise New York. The road will be run and lighted by electricity. The directors named in the application for the certificate of incorporation are W. Wetmore Cryder, president of the Madison Square Bank; William N. Amory, William H. Devlin, Murray Carrington Douglas, Alexander Douglas Cryder, James E. Chandler, C. Lawrence Perkins, Peter T. Barlow, Solomon Hanford, Stephen H. Olin, of New York, James E. Bedell, of Brooklyn, and S. M. L. Barlow, of Glen Cove. Besides these gentlemen there are parties resident in Boston, New Haven and New York of recognized financial ability to put the scheme through, actively connected with the company.

A Draw to Open by Electricity.—An iron draw at Bridgeport, weighing 300 tons, attached to the new bridge over the Pequonnock River, recently built by Dean & Westbrook, of New York, will be turned by electricity and is believed to be the first of the kind in the country. To move the draw in the ordinary way requires the muscle of from two to five men, according to circumstances, and as it must be opened an average of twenty times daily throughout the year, the labor is great as well as expensive. The city authorities, with a view to lessen both, have introduced an electric motor of seven and a half horse power, the force being transmitted from the Bridgeport electric light plant half a mile away. This motor makes 1,600 revolutions each minute, and by the use of gearing the number is reduced, producing a power both steady and sure. The motor may be reversed, so as to turn the draw either way.

St. Joseph Mo.—Col. Joseph A. Corby, superintendent of the Avenue and Citizens' lines, in speaking with regard to the proposed sale to an Eastern syndicate, says. "We have been negotiating with New York and Boston parties for several months, but they have refused to make any proposition to us until we had the electric franchise. That secured they said they would at once enter into negotiations. If they purchase, and I have every reason to think they will, the two lines will without delay be put in first class condition and the equipment made as good as can be purchased. Their idea will be to give fast service and to run a largely increased number of cars, with the idea in view of building up the ends of town into which the lines go, and ultimately increasing the service. If the purchase is not made we shall not feel badly at all, but shall at once go to work and ourselves put in the plant. So whether the lines change hands or not, they will have an electric equipment before summer is over."

Rochester, N. Y.—The Thomson-Houston Electric Company has just been awarded a contract for the equipment of the electric railway from Rochester, N. Y., to Charlotte. The contract is to be completed by the 1st of June. There will be sixteen cars, eight of which will be closed and eight open. The seats will face one way, with an aisle in the centre. Each car will be equipped with two 15 h. p. Thomson-Houston motors, and will be lighted by five electric lamps. The power station will be located near the Central Railroad crossing, and will be equipped with two 100 h. p. engines, and two 80 h. p. Thomson-Houston generators. The electric railway people state that the contract was awarded to the Thomson-Houston Company, because it was found that that company would do the work in a thoroughly satisfactory manner, and that its apparatus was of such a quality as to stand the severest tests to which it may be subjected. They made an especial point of its durability, and the minimum of repairs required by it. The contract was not given to the Thomson-Houston Company till various of its roads had been inspected and the railway people had thoroughly satisfied themselves that the Thomson-Houston system was best.

PERSONALS.

Mr. W. H. Elkins, recently of the American Company, is devoting his time in Boston to some important experimental work.

Mr. J. F. Morrison has been reappointed by President Cleveland as a member of the Committee on the Chesapeake & Delaware Ship Canal.

Mr. Chas. E. Dustin, vice-president of the Schuyler Electric Company, who has been seriously ill for several months, is once more at his post ready for business.

Gov. H. Howard—for it can be no one else—has an able and interesting letter in the Providence *Journal*, on the influence of the Mahdi, and the importance and gravity of the present situation in Egypt.

Mr. Benson Bidwell is now busily engaged at Newark, O. building an electric road to use "Bidwell's indestructible porcelain dynamo and motor." A hose can be turned on these machines, it is claimed, without any harm.

Principal E. H. Boyer, of the New York Public Schools, delivered an address at Broome street last week, on "Electricity, Its Theory, Sparks and Shocks." It was illustrated by apparatus, and at its close he urged upon all his hearers to study electricity.

Prof. E. P. Roberts, of Cornell University, delivered an address before the Buffalo Electrical Society, on Feb. 18, on the electric light. Mr. A. C. Terry presided, and there was a large attendance of members and friends. The address was illustrated and proved a very able and interesting treatment of the subject.

Col. Rowland R. Hazard is just home from England, where he has been busily engaged organizing the Central Subway Railway Company of London, to build a road which shall be operated by electric motors and shall employ details of the Hazard system of subway construction. The company is well backed and has already deposited £41,000 as a guarantee. The capital called for is £900,000, and is all subscribed. Col. Hazard has our heartiest wishes for the success of the work.

Mr. J. J. Wood, formerly of the American Electric Manufacturing Company, is fitting up an extensive factory at 211 Navy street, Brooklyn, for the manufacture of arc light apparatus under his patents. The apparatus will be put on the market by the Ft. Wayne Jenney Company through Mr. H. C. Adams, who has his offices now at 115 Broadway. We are extremely glad to find Mr. Wood once more actively at work. He is a practical electrician whose ability the industry can ill spare.

Prof. L. P. Kinnicutt, of the Worcester, Mass., Polytechnic Institute, writes as follows to the local paper: A cablegram appeared in the *Spy* about two weeks ago announcing that Prof. Gerhard Kruss, of Munich, had succeeded in decomposing the two well known metals, nickel and cobalt. German chemical periodicals just received show that what Professor Kruss has really done is to obtain from both nickel and cobalt a new element which was contained in them as an impurity. The two elements, nickel and cobalt, thus still remain elements, and have not been decomposed into any simpler substance. It is as though copper was an unknown substance, and that German silver was considered as pure nickel, and a chemist discovered that it contained, besides nickel, also copper.

Supt. W. Murray, of the New York police force, in his report on the late great car strike, says: "I feel it incumbent upon me to urge the speedy adoption of the best and most serviceable police signal system, whether by telephone, telegraph, or other approved method, in order that detailed information can be sent to and from the Central Office, or from the several station houses, with the greatest facility. The employment of policemen as messengers in time of riot or disorder not only uses much valuable time, but each message temporarily removes an officer from a place where, perhaps, his services may be badly needed. A mob grows formidable when it has small resistance, and gathers momentum and encouragement as it proceeds. Prompt communications to enable the police force to be rapidly concentrated at such a time is invaluable, and it is of the utmost importance that the department should be provided with the very best signal system now in use or that may be hereafter devised."

MISCELLANEOUS NOTES.

Toronto, Can., is investigating the subject of underground wires.

Waterloo, N. Y.—The Waterloo Electrical Company has been formed by Francis Bacon, A. J. Mercer and W. L. Mercer, with a capital stock of $30,000.

The New York Linemen's Union has requested Mayor Grant to lessen his opposition to the stringing of electric wires above ground, because the use of the subways would eventually throw its 500 members out of employment.

The Electro-Optic Manufacturing Company has been formed at Chicago; capital, $10,000; for the manufacture of electrical, optical, chemical, medical, mathematical, and mechanical goods, machines, and appliances; incorporators, G. B. Reynolds, H. C. Sample, and G. D. Stout.

Electricity by the Cart Load.—A company is in course of formation in Berlin, with a capital of $500,000 for the manufacture of storage cells and their supply to consumers. The company will organize a service of carts, which will take the charged cells to their customers, and take back the discharged cells to be recharged at the works.

Mr G. G. Stillman, agent for the Spencer damper regulator, 19 Pearl street, Boston, reports orders from the Thomson Electric Welding Company, Lynn, Mass.; Massachusetts General Hospital Boston; Plymouth, Mass., Electric Light Company; Franklin, Mass., Electric Light Company; Framingham, Mass., Electric Light Company; West End Electric Railway, Boston.

California Electrical Society.—The following officers have been elected to hold office for one year: Professor N. S. Keith, president; O. Brooks, vice-president; W. W. Wright, secretary; C. R. Ryland, Jr., treasurer; P. B. Brown, S. H. Taylor and T. H. McDonald, Executive Committee. The society starts with about ninety charter members. The dues are fifty cents per month; initiation fee two dollars. It has been proposed to affiliate the society with the San Francisco Mechanics' Institute.

The Electrical Accumulator Company has begun a second suit in equity against the Julien Electric Company, charging infringement of the well-known Sellon patent, covering the use of an alloy plate in secondary batteries. Damages and an injunction are asked for. The same corporation has also instituted suit in equity against the Gibson Electric Company on three several patents of Faure, Swan and Sellon, covering improvements in secondary batteries. A termination of these suits favorable to the complainant will, it is claimed, place it in complete control of the secondary battery business, and render all those now using batteries manufactured or sold by either defendant corporation liable in damages.

BUSINESS NOTICES.

Patterson, Jordan & Gottfried, 146-150 Centre street carry a complete stock of brass and iron machine and wood screws, cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rod, sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

Shaw & Geary.—Under date of February 11 due notice is given of the dissolution of the copartnership of Shaw & Geary, the electrical manufacturers of Philadelphia. The business will be continued at 53 North Seventh street under the name of J. Elliott Shaw & Co.

The Ætna Machine Company, Warren, Ohio, have received an order for two of Smith's furnaces and valves for the Hartman Steel Company, Beaver Falls, Pa. Also an order of one of Smith's large gas furnaces and valves for the Chicago Horse Shoe Company, Chicago, Ill.

The Spencer Damper Regulator.—By inadvertence, the address of Mr. G. G. Stillman, agent for the Spencer damper regulator, described in our issue last week, was given as Lynn, Mass. We hasten to state that Mr. Stillman's headquarters for that useful appliance are at 19 Pearl street, Boston, Mass.

Curtis Regulator Valves.—Mr. C. H. W. Copeland, of New Orleans, writes thus to the Curtis Regulator Company: "I take pleasure in saying that the regulator valves put on by me in this State last year have proved perfectly satisfactory in every respect. In the coming season I anticipate no trouble in placing your valves not only in places where they are not now used, but also in those places where the other makers have attempted to do what I did last year."

The New York Belting and Packing Company, 15 Park Row, New York, manufacture a large line of vulcanized rubber specialties, all of which are very popular. The special vulcanized rubber belting with smooth metallic surface for electric lighting stations, lately introduced by the company, is an immense success.

The Ætna Machine Company, of Warren, Ohio, have received an order from Chicago parties for another of their large engines—this time a 500 h. p.—with boilers and fixtures all complete, for the Chicago Steel Rail Company, of Chicago, Ill. The engine is to drive a train of rolls in the new mill which is now building at Hartford City, Indiana.

The Reliance Gauge Company, of Cleveland, O., had quite a complete display of their Reliance safety water columns at Chicago last week, and the many readers of THE ELECTRICAL WORLD who have manifested an interest in these safeguards were given an opportunity to investigate their merits, as the columns were exhibited in operation.

Gould & Eberhardt, the tool builders of Newark, N. J., write us: "We are pleased to report recent shipment of our patent Eberhardt's automatic gear cutters and drill presses to the noted drill shops at Koping, Sweden, and also to Kharkoff, Russia. This we take as an indication of the increasing favor with which the better class of American tools are looked upon in foreign countries."

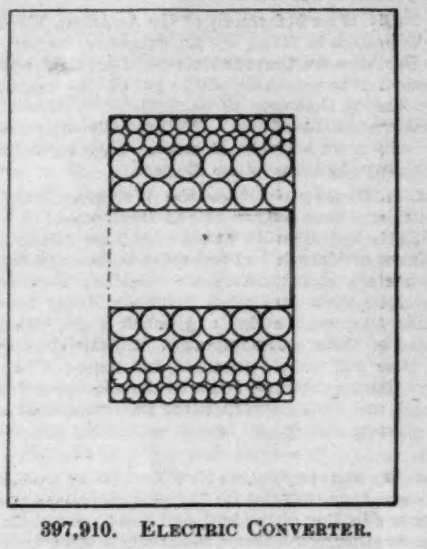
The Garlock Packing Company, of Palmyra, N. Y., and Rome, Ga., are meeting with a brisk demand for their various styles of packing, including the "elastic ring," the "spiral," and the "sectional." This packing should find a good reception in electric light plants. The elastic packing is well known to thousands of steam engineers, while the sectional is now making its way into the good graces of as many more, being specially adapted for efficient service with high-speed engines. It is a thoroughly lubricated packing, and answers every requirement in connection with pistons and valve rods, etc.

Live Steam Purifiers.—The evils and losses growing out of incrustation in steam boilers is an old story, but one of such great importance as to justify frequent reference to it. A forcible reminder of what impurities are contained in ordinary feed-water for boilers is afforded by the heap of lime deposits retained in a Stilwell live steam purifier in use on the boilers at the City Water Works, Dayton, O. The photograph of the deposits obtained at one cleaning out of the purifier shows a big mound of impurities. But for the use of the purifier these deposits of lime would have been inside the boilers, and the great damage to the boilers, and increased consumption of fuel it would have caused, will be readily appreciated by all practical engineers. This purifier is manufactured by Stilwell & Bierce Mfg. Company, Dayton, O.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED FEBRUARY 19, 1889.

10,986. Reissue. Electric Discharge Device; R. Belfield, Pittsburgh, Pa., Assignor to the Westinghouse Electric Company, of same place. Application filed Jan. 21, 1889. This is a reissue of patent No. 392,400, dated Nov. 6, 1888. It relates to an apparatus



397,910. ELECTRIC CONVERTER.

consisting of discharge points which are directed toward the pulley and belt wheel of the generator.

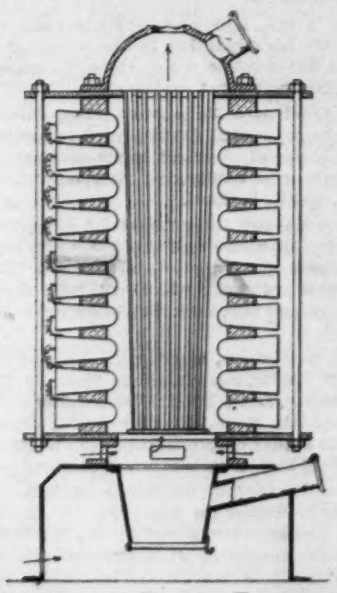
397,906. Electric Lighting System; J. A. Galvin, Steelton, Pa. Application filed April 16, 1888. This is a special switch for operating different groups of incandescent lamps from a single point.

397,910. Electric Converter; Ludwig Gutmann, New York, N. Y. Application filed April 26, 1888. It has usually been the custom heretofore to cut the plates of the converter in two places in order to get the coils into their proper position. By this invention the plate has but one one cut, and this extends from one opening to the other. See illustration.

397,945. Electric Battery; E. A. Sperry, Chicago, Ill. Assignor to F. S. Terry, of same place. Application filed March 24, 1888. A series of contractible rings are provided with clamping devices which secure the carbons in place.

397,965. Electrical Battery; Wm. Burnlee, North East, Pa., Assignor to two-thirds to Samuel A. Davenport, of Erie, and Chas. A. Hitchcock, of North East, Pa. Application filed June 11, 1888. A permeable sack secured to and suspended from an opening in the jar cover, with carbons and depolarizing material inclosed within the sack.

397,966. Electric Current Indicator; Wm. A. Carey, Malden, Mass. Application filed Oct. 20, 1887. In this instrument



398,272. ELEMENT FOR THERMO-ELECTRIC BATTERIES.

the current is not allowed to pass through it except when an indication is desired. It is explained that the magnet will not become weaker and weaker under use for this reason.

(1) 397,969. (2) 398,132. Galvanic Batteries; Eben D. Cross, Chicago, Ill. Applications filed Dec. 10, 1888, and Aug. 2, 1888, respectively. (1) In a galvanic battery, the combination, with a couple of cells and suitable electrodes and excitants therein contained, of a third supply cell, a fume-conducting passage arranged to conduct the fumes from one of said cells and discharge the same within the supply cell, capable of being charged by said fumes. (2) The negative element is separated into two parts electrically connected together, and arranged in separate

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397,977. Telegraphy; Charles E. Dressler, New York, N. Y. Application filed May 26, 1887. The invention consists first of a galvanometer placed in the main electric circuit and a recording or message receiving instrument placed in another or relay circuit, opened or closed or otherwise affected in accord with the operation of the galvanometer with which said receiving instrument is so combined.

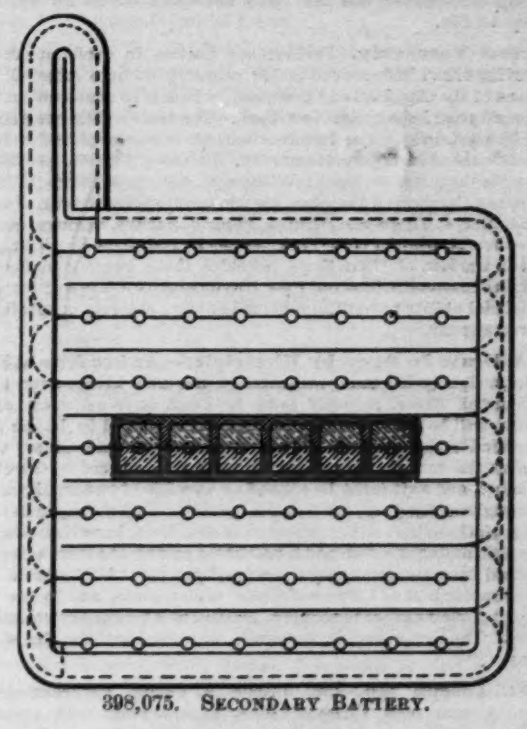
398,025. Insulator; W. C. Brown, Tarrytown, N. Y. Application filed Dec. 28, 1888. The insulator is formed in two halves, bored axially to receive a binding screw. One of the halves is furnished with a recess for the wire and the other half with a projection adapted to shut off leakage from the wire to the screw.

398,035. Floating Telegraph Station; U. Dieulevcult, Treguier Cotes-du-Nord, France. Application filed June 25, 1888. A float is anchored to the bottom, and the cable passes up from the anchor to the float where connections may be made with instruments aboard ship, and telegraph messages sent from the ship to shore or to another vessel.

398,069. Safety Gage; A. F. Nagle, Chicago, Ill. Application filed Oct. 20, 1888. The pressure of the steam acts against a spring to force two electrical contacts together when the pressure reaches a certain point.

398,075. Secondary Battery; J. T. Pedersen, New York, N. Y. Application filed July 30, 1888. The supporting plate is formed from a strip of rolled or cast lead which is bent upon itself to form a series of flattened horizontal convolutions, which convolutions are bound together. The strips are formed with pockets for the active material. See illustration.

398,121 Equalizer for Electric Currents; Sigmund Bergman, New York, N. Y. Application filed Nov. 10, 1888. The principal object of this invention is to provide an equalizer for electric light currents which, for a given amount of work, will occupy less space than the ordinary equalizer. This is accomplished by using



398,075. SECONDARY BATTERY.

an iron frame instead of a wooden frame and in constructing the frame in a special manner.

398,122. Static Induction Generator; Edward T. Birdsall, New York, N. Y. Application filed Nov. 14, 1888. The glass discs have varnished surfaces and are provided with strips of foil. Each of the discs has a central notched opening and wooden hubs fit into these openings and are secured by screws. The machine also embraces other details. See illustration.

398,133, Electric Belt; Samuel De Baun, Kansas City, Mo. Application filed Nov. 22, 1888. This belt is designed to furnish convenient means for the transmission of the battery current to local parts of the body.

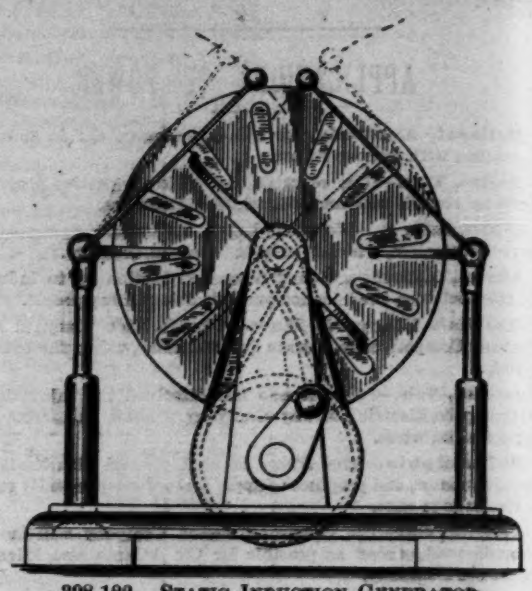
398,144. Door-Spring Connection for Electric Burglar Alarms; John Geary, Philadelphia, Pa., Assignor to Shaw & Geary, of same place. Application filed Aug. 22, 1888. The details of constructions of this circuit closer render it compact and cheap.

398,194. Secondary Battery; A. Timmis, Westminster, Eng. Application filed Oct. 1, 1888. A plate composed of litharge and a solution of sulphate of ammonia and a supporting frame.

398,222. Railway Car; John A. Brill, Philadelphia, Pa. Application filed Sept. 20, 1887. The battery is put into the car sides by passing it through a door in the dash-board and another door in the end of the car.

398,272. Element for Thermo-Electric Batteries; Max Mestern, Turin, Italy. Application filed Nov. 22, 1888. An element for thermo-electric batteries comprising two electrodes composed of alloys of metals of varying refractory power, that electrode more directly exposed to the heat being formed of an alloy of greater refractory power than that of the other electrode, in combination with a conductive sheating constructed of a metal of greater refractory power than either of the electrodes, said sheathing being reinforced at that point which is more directly exposed to the heat, and a fire-proof lining interposed between said sheathing and the more fusible electrode.

398,288. Switch for Electric Circuits; C. C. Stirling, Hartford, Conn., Assignor to Charles E. Dustin, of same place. Application filed June 21, 1887. The invention consists of an elastic spring fastened at either end, operated by a double crank swiveled upon the same insulating plate upon which the elastic spring is mounted, which latter controls means for completing



398,122. STATIC INDUCTION GENERATOR.

the circuit between the circuit terminals arranged in co-operative proximity thereto.

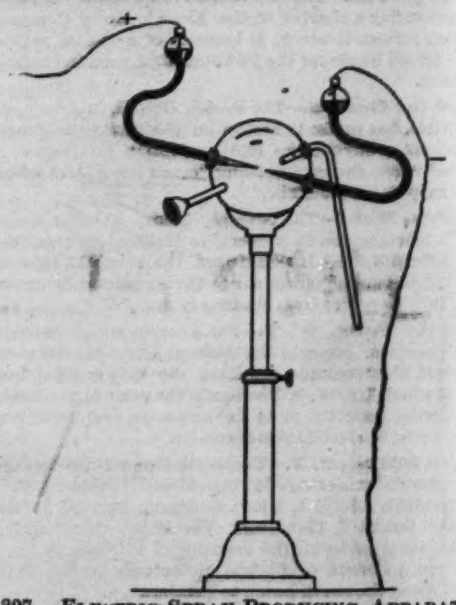
398,314. Stop Mechanism for Steam Engines; H. L. Currier, Lynn, Mass. Application filed May 14, 1888. A weight is geared to the throttle valve of the engine, and when it is released by an electro-magnet operated by push button, it acts to cut off steam and stop the engine.

398,327. Electric Spray-Producing Apparatus; H. A. B. Huguet de Vars, Paris, France. Application filed Nov. 30, 1888. In this apparatus a globe is provided with openings in which are placed two tubes containing electric wires. The globe also has another pair of openings, one for receiving a ventilating tube and the other a mouthpiece. The passage of the current causes a spraying of the liquid floating through the tubes and the vapor thus produced may be inhaled by a patient. See illustration.

PATENTS EXPIRED FEBRUARY 27, 1889.

123,984. Telegraphy; Thomas A. Edison, Newark, N. J. Patented Feb. 27, 1872. A series of automatic telegraph instruments in one main telegraph line, with locking mechanism and indicators, operated by electro-magnets and arranged so as to throw into act on the desired receiving instrument.

124,104. Electric Clock; E. Wilson, Elizabeth, N. J. Patented Feb. 27, 1872. The principal feature of this invention lies in the



398,327. ELECTRIC SPRAY-PRODUCING APPARATUS.

forming of the make and break contacts of two different kinds of metal to prevent oxidation.

124,126. Gas Lighting; Samuel Gardner, Washington, D. C. Patented Feb. 27, 1872. This is simply a switch containing a number of contacts by the closing of which the gas at the several burners is first turned on and then ignited.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co, Ltd., Potter Building, N. Y.